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THE
JOURNAL
OF THE
BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY

H. M. PHIPSON, C.M.Z.S.,

AND

W. S. MILLARD.

VOL. XV.

Consisting of Five Parts and containing Twelve Coloured Plates, Eighteen Lithographs, Two Photographs and Sixty-two Blocks.

Dates of Publication.

Part	*I (Pages* 1 *to* 161)	10*th June*, 1903.
„	*II (Pages* 162 *to* 374)	28*th Oct.*, 1903.
„	*III (Pages* 375 *to* 536)	15*th Feb.*, 1904.
„	*IV (Pages* 537 *to* 735)	27*th June*, 1904.
„	*V (Index, &c.)*	16*th Oct.*, 1904.

Bombay:
PRINTED AT THE TIMES PRESS, BOMBAY.

ERRATA.

Page 304, line 21, after the figure 26 read " *Drupadia.*"

Page 306, line 15, for " *Xeronia* " read " *Eronia.*"

Page 414, in the figure, the letterings " pt " and " pal " should be transposed.

Page 415, line 5, for " *Wope* " read " *Hope.*"

Page 511, last line, for " *rubescens* " read " *erubescens.*"

Page 510, line 26, }
Page 513, line 17, } for " *Toughe*" read " *Touglu.*"

Page 514, line, 30 for " *rink,*" read " *ring.*"

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ERRATA IN No. 1, Vol. XV.

In page 78, *after* line 7—*insert* as line 8, "Tribe XI, Polypodium."

In „ 90, in 16th line from foot—*for* "Thum," *read* "Thun."

In „ 102, in line 13 from foot—close up the "* *" and the word "Fronds."

In „ 103, in line 19 from top—*for* "Tribe B," *read* "Tribe XIII."

In „ 106, before 14th line from foot—*insert* "Sub-order VI," Ophioglossaceæ.
"Genus 33, Ophioglossum."

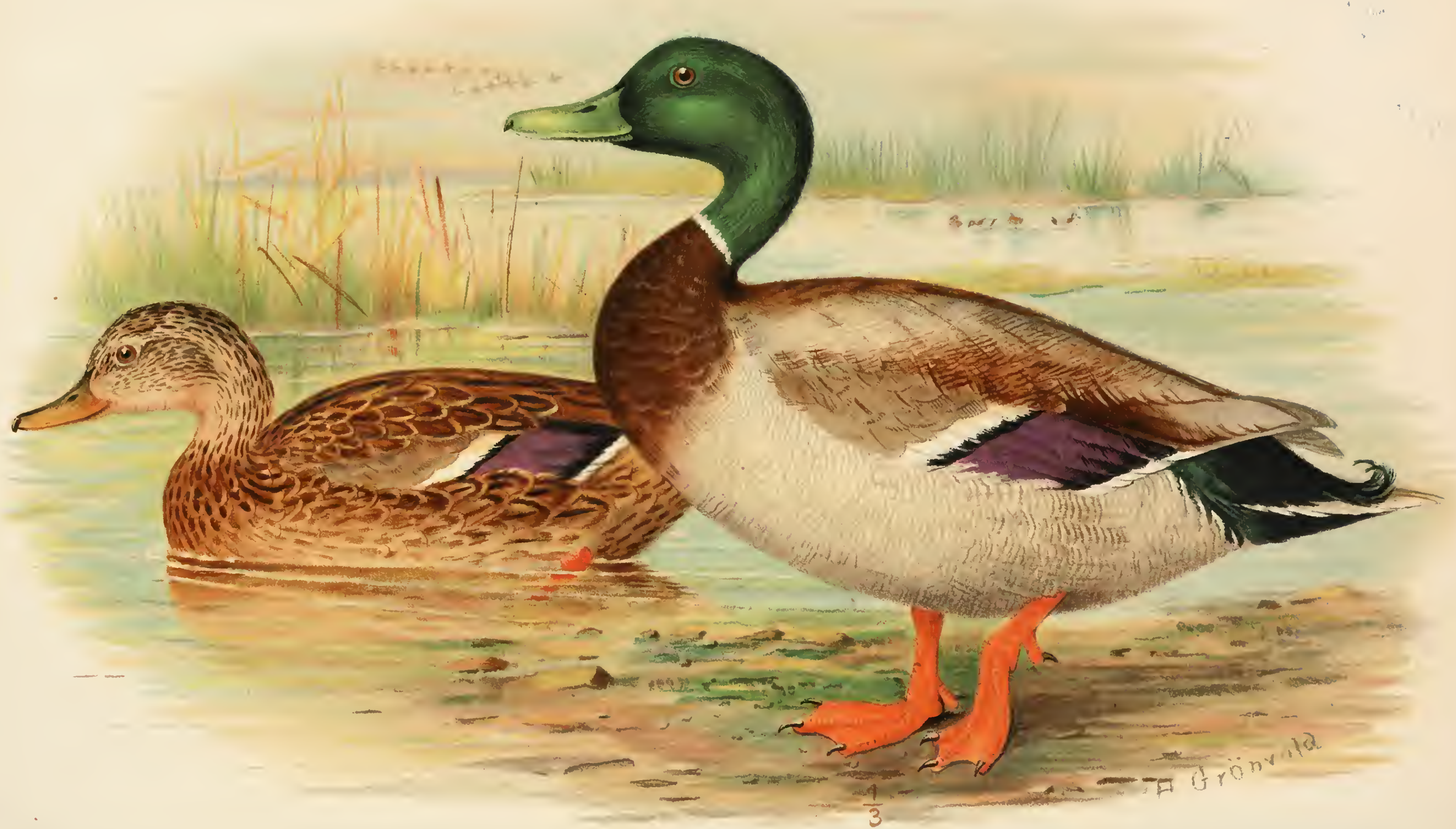
In „ 106, in 2nd line from foot—*for* "Ophisoglossum," *read* "Ophioglossum."

In „ 107, in 7th line from top—*after* "Mr. Clarke," *insert* "also."

In „ 108, in top line *for* "five," *read* "fine."

In „ 109, 7th line from top—*for* "Walliches," *read* "Wallich's."

In „ 111, at foot of page *add*—"End of Part III, The General List."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THE COMMON WILD DUCK OR MALLARD.

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JOURNAL
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Natural History Society.

Vol. XV. BOMBAY. No. I.

NEW SPECIES OF INDIAN HYMENOPTERA.

By Major C. G. Nurse, 13th Bombay Infantry.

The following new species belong to the family Sphegidæ. The most interesting are two species of the little known genus Homogambrus, of which the ♀ has not previously been described. Three species of the genus Palarus have also been included below; in the Indian region this genus has hitherto only been recorded from Ceylon. Two species in the following paper were sent me by Mr. G. C. Dudgeon, who also forwarded their descriptions in M.S. His notes on *Stigmus cuculus* are particularly interesting, as his observations confirm those of Geraud that certain species of this genus store their nests with Aphidæ.

Astata quettæ n. sp.

♀ Smooth and shining, except the median segment, which is finely longitudinally striate; front very convex, pronotum somewhat long, median segment gradually narrowed and rounded posteriorly. Black; the apices of the femora, and the whole of the tibiæ and tarsi bright red; abdomen red, the 3rd and 4th segments reddish black; pubescence sparse, greyish black; wings hyaline, infuscated at apex, radial cell very short, its apex not reaching beyond the apex of the 3rd cubital cell, stigma dark testaceous, nervures and tegulæ pale testaceous.

♂ Differs from the ♀ as follows: less conspicuously shining, front and mesonotum minutely but sparsely punctured, pubescence grey, longer and denser, abdomen often reddish black; wings clear hyaline, their apices not infuscated, stigma less dark.

Long. ♀ 5-5 *mm.* ♂ 7 *mm.*

Habitat: Quetta.

This species is nearest to *A. lubricata* (Nurse) described from Deesa, but differs in the sculpturing, and in the greater part of the femora being black, and not red. I have several specimens of the ♂, but only one of the ♀, and as it is much smaller than the other sex, it may be an unusually small specimen.

HOMOGAMBRUS CREON, n. sp.

♂ Clypeus and front smooth and shining, mesonotum, scutellum, and post scutellum sparsely punctured, median segment striate, the striations longitudinal at base, oblique at the sides, almost semicircular at apex in the centre, abdomen minutely punctured ; front above the base of antennæ raised almost tuberculate, median segment roundly truncate posteriorly, abdomen scarcely as long as thorax. Black; the mandibles, legs, and apical abdominal segment red ; the apical margins of the abdominal segments very narrowly reddish ; pubescence silvery, in some lights with a golden tinge, especially on the clypeus and front; the bases of 1st and 2nd abdominal segments more or less pruinose ; wings hyaline, nervures and tegulea pale testaceous.

Long. 6-7 *mm.*

HABITAT : Deesa, five specimens : Quetta, one specimen. The latter has the whole abdomen red, but does not appear to differ in other respects from the Deesa specimens, and I conclude it must be the same species.

This genus has not previously been recorded from India, in fact only a few species are known.

HOMOGAMBRUS MENELAUS, n. sp.

♀ Front minutely but not very regularly, vertex and thorax more coarsely punctured, median segment finely reticulate, abdomen minutely punctured ; head broader than the thorax, clypeus very prominent and convex, its apical margin nearly transverse, with two notches in the centre ; the portion of the front above the base of antennæ raised, smooth and shining ; eyes convergent towards the vertex, but not meeting, their distance apart at vertex being about half as much again as the distance of the anterior ocellus from the margin of the eyes ; posterior ocelli flattened, but not obsolete ; antennæ with the scape as long as the 2nd and 3rd joints of the flagellum united, the second being slightly the longer ; median segment with a semicircular portion at base reticulate ; abdomen scarcely longer than thorax, apical segment with a smooth and not very clearly defined pygidium.

Black and shining; the apical margins of the abdominal segments, the tibiæ and tarsi, testaceous: a little short, golden, pubescence on the clypeus and front; wings hyaline, nervures and tegulæ pale testaceous.

Long. 4—5-5 *mm.*

Habitat : Peshin, Baluchistan, three specimens; Deesa, one specimen. The latter, however, differs from the Peshin specimen in having the whole of the legs red, and the apical margins of the abdominal segments not testaceous. The appendicular nervure is also more clearly defined. But the sculpture does not appear to differ from that of the other specimens, and I think that it is the same species.

No ♀ of this genus has, I believe, been hitherto described, but, although I have not obtained a ♂ of this species, I have little doubt that I have correctly placed it. It is too small to be the other sex of *H. creon* above.

Tachytes dilwara, n. sp.

♀ Head and thorax extremely minutely and closely punctured, abdomen minutely aciculate; clypeus convex, transverse anteriorly; an impressed line from between bases of antennæ through anterior ocellus to vertex; median segment with a median longitudinal furrow. Black; the greater part of the femora, and the whole of the tibiæ and tarsi red; pubescence on clypeus, front, and legs golden, on the thorax and base of first abdominal segment greyish and somewhat sparse, except on the median segment; pile on abdomen silvery, a few stiff, black hairs on apical abdominal segments, pygidium with stiff golden-red and black hairs intermingled, appearing golden-red when viewed obliquely; wings flavo-hyaline, nervures pale testaceous, tegulæ red; third cubital cell much narrowed, narrower than the second both above and below.

Long. 12-16 *mm.*

Habitat : Mount Abu.

Nearest to *T. modesta*, from which it can be distinguished by the hairs on the pygidial area being black and golden-red, not silvery.

Tachytes shiva, n. sp.

♀ Differs from *T. dilwara* above only in the median segment being shorter and the whole of the legs being black, not red; the legs are covered with golden pile, and the spines are testaceous red, as in *T. dilwara.*

Long. 16 *mm.*

Habitat. Deesa; Mount Abu.

LARRA NEÆRA, n. sp.

♀ Head shining, the clypeus and vertex minutely and closely punctured, the extreme apex of the clypeus impunctate ; mesonotum, scutellum, and postscutellum rather more deeply and less finely punctured than the head, median segment finely transversely striate, with punctures between the striæ ; abdomen shining, the bases of the segments extremely minutely punctured, their apices impunctate ; apex of clypeus waved, scarcely emarginate ; front above the antennæ with three sulcations, impunctate and very shining ; ocellus situated in a hollow, another and slighter hollow where the posterior ocelli should be ; mesonotum with a slight impressed median longitudinal line at base ; median segment roundly truncate posteriorly, with a trace of a longitudinal carina ; pygidium with a few scattered punctures. Black ; the greater part of the mandibles, the intermediate and posterior femora and tibiæ red ; all the spines of the legs more or less rufo-testaceous ; scarcely any pubescence except on the thorax below, where it is short and greyish ; wings fusco-hyaline, the hind wing at base hyaline, nervures dark testaceous, tegulæ rufo-testaceous.

Long. 13-17 *mm.*

HABITAT : Quetta.

Allied to *L. erratica*, but may be distinguished from it by having the intermediate femora and tibiæ, and the posterior tibiæ, red and not black.

PALARUS INDICUS, n. sp.

♂ Clypeus with a few shallow punctures, front, vertex, and pronotum impunctate, mesonotum and scutellum sparsely punctured, postscutellum impunctate, median segment with oblique, almost semicircular, striations, abdomen sparsely and shallowly punctured ; mandibles with a wide incision on their outer margin, eyes at vertex about as far apart as the length of the third joint of the antennæ ; clypeus small, very convex, nearly semicircular, its apex rounded ; front with the portion between the base of antennæ and the ocelli much raised, almost tuberculate, with a median longitudinal impressed line ; anterior ocellus large and round, situated in a deep hollow ; posterior ocelli elongate-oval, with a fovea between them ; antennæ with the scape short and stout, the third joint the longest, fourth and fifth subequal ; pronotum moderately wide, depressed in the centre ; median segment rounded in the middle posteriorly, with a wide median depression, deepest posteriorly, the lateral angles slightly raised and very conspicuous; abdomen longer than the head and thorax united, first ventral segment with two conspicuous tubercles, third ventral segment very much produced below, seventh ventral segment with two small tubercles, pygidium elongate, with a deep median groove, its apex notched; a little short, sparse, silvery pubescence on the front, cheeks, legs, and apical abdominal segments. Head with the clypeus, anterior portion of front, vertex, and occiput black; antennæ yellow at base, gradually becoming red at apex; thorax black, the pronotum yellow, tubercles and a spot above them yellowish red, scutellum and postscutellum red; abdomen yellow, the first segment and the depressed portions of the remaining segments, including the pygidium, light red; the margins of all the segments when extended very narrowly black; legs red. Forewing flavo-hyaline, its apical margin lighter, the portion about the appendicular cell infuscated; hindwing lighter flavo-hyaline, its margin hyaline; nervures testaceous, tegulæ reddish yellow; second cubital cell very slightly stalked, third cubital cell reaching just beyond the apex of the radial cell; both recurrent nervures received into the second cubital cell, the first just within its inner angle, the second one-third the length of the cell on the cubital nervure from its outer angle.

Long. 16 *mm.*

HABITAT: Deesa; a single specimen.

PALARUS QUIESCENS, n. sp.

♀ Clypeus with a few shallow punctures, front impunctate; mesonotum minutely and closely punctured at the sides, sparsely and coarsely in the centre, scutellum with a few scattered punctures; median segment striate, the striæ longitudinal at base, oblique at the sides, transverse at apex; abdomen finely and closely, but somewhat irregularly, punctured; the distance apart of the eyes at vertex is about the length of the third joint of the antennæ, which is the longest; clypeus small, convex, its anterior margin rounded, from its posterior margin to the anterior ocellus runs a conspicuous ridge; anterior ocellus the largest, the posterior ones oval; pronotum narrow, and depressed below the level of the mesonotum; median segment below the level of the postscutellum, its posterior lateral angles raised and conspicuous; pygidium long and narrow, impunctate, with its margins raised; ventral segments not produced below. Yellow; the tips of the mandibles, two irregular marks on the front between the base of antennæ and the vertex, the mesonotum, except a U-shaped marked, a spot·behind the tegulæ, the base and median furrow of the median segment, the base and apex of the abdominal segments, and small round lateral spots on the latter, black; antennæ and the bases and apices of some of the abdominal segments more or less red; pygidium yellow at base, red at apex; a little silvery pile on the front; wings hyaline, nervures testaceous, tegulæ yellow; the appendicular cell is not very clearly marked, the third cubital cell reaches considerably beyond the radial cell, the third cubital nervure being received near the apex of the radial cell, which is broadly rounded; the second cubital cell, which is only very slightly stalked, receives both recurrent nervures, the first well within its inner angle, and the second at a slightly greater distance from its outer angle.

♂ Differs from the ♀ as follows: first ventral segment with two small tubercles, second ventral segment much produced below, pygidium shorter, much broader, tridentate at apex, the middle tooth slightly, but not much, longer than the lateral ones; the third cubital nervure is received further from the apex of the radial cell and the first recurrent nervure is interstitial, or nearly so, with the first transverse cubital nervure.

Long. 8-10 *mm.*

HABITAT: Deesa; five specimens. One ♀ has the yellow markings much less developed than the others, and the greater part of the thorax, especially below, is black.

PALARUS FABIUS, n. sp.

♀ Allied to *P. quiescens* above, but differs as follows: smaller and less robustly built comparatively, mesonotum impunctate, abdomen more sparsely punctured, thorax with long silvery pubescence, no U-shaped mark on mesonotum, and less yellow on the thorax generally; wings with the nervures paler testaceous, the first recurrent nervure interstitial with the first transverse cubital nervure; all the femora and sometimes the tarsi more or less red.

♀ Smaller than the same sex of *P. quiescens;* the front, except the clypeus, black, thorax darker and without the U-shaped mark on the mesonotum; the black markings of the abdomen more developed, pygidium with the central tooth much longer than the lateral ones, all the femora more or less black.

Long. 6-8 *mm.*

HABITAT : Deesa.

The above three species are easily distinguished from *P. orientalis*, the only species previously recorded from the Indian region, by the much greater convergence of the eyes.

MISCOPHUS QUETTAENSIS, n. sp.

♀ Head, thorax, and abdomen very minutely and closely punctured, median segment finely obliquely striate ; clypeus slightly raised in the centre, its apex almost transverse ; front with a median longitudinal impressed line ; abdomen scarcely longer than thorax. Black, with bronzy reflections ; basal two abdominal segments dark red ; head, thorax, apical portions of abdominal segments, and legs with sparse, short, silvery pile ; wings hyaline, their apices slightly infuscated.

♂ Similar, slightly smaller, abdomen longer in proportion, the segments slightly constricted, front with golden pile.

Long. 5 *mm.*

HABITAT : Quetta ; two specimens.

This species may be easily known from both *M. rothneyi*, and from *M. difficilis* described below, by its being punctured.

MISCOPHUS DIFFICILIS, n. sp.

♀ ♂ Head, thorax, and abdomen smooth and shining ; clypeus much broader than long, rounded anteriorly ; front between base of antennæ and anterior ocellus with a longitudinal impressed line ; median segment rounded posteriorly, with a trace of a median longitudinal furrow, the segment microscopically striate at base, the striæ oblique at the sides, transverse in the centre. Black ; the scape of the antennæ, the tibiæ, and tarsi red ; wings hyaline, forewing fuscescent along the costal margin, nervures and tegulæ black.

Long. 3-4 *mm.*

HABITAT : Peshin, Baluchistan ; six specimens.

This is, I believe, the smallest species yet described.

GASTROSERICUS ELECTUS, n. sp.

♀ Head and thorax minutely aciculate, abdomen smooth ; clypeus much broader than long, emarginate anteriorly ; median segment rounded posteriorly ; pygidium with a few scattered punctures. Head and thorax black ; the base of the mandibles, clypeus, the greater part of the scape and sometimes the flagellum of the antennæ, the abdomen, the greater part of the femora, and the whole of the tibiæ and tarsi, red ; head, thorax, and abdomen covered with a short, silvery pile, which in some lights has a golden tinge; pygidium without pubescence (possibly abraded); wings hyaline, nervures testaceous, tegulæ red.

Long. 5-6 *mm.*

HABITAT: Deesa; three specimens.

Of the four Indian species hitherto described, three, *viz.*, *G. rothneyi*, *G. wroughtoni*, and *G. rufitarsis* can be at once distinguished from the present species by their much larger size; *G. binghami* has the legs more or less yellow; *G. waltlii* from Egypt has the abdomen chiefly black, and is much larger.

TRYPOXYLON MEDIATOR, n. sp.

♀ Head, thorax, and abdomen impunctate, median segment with the basal half somewhat coarsely reticulate; clypeus much produced anteriorly, its margin rounded, and reaching well below the lower margin of the eyes; antennæ close together at base, inserted some distance above the posterior margin of clypeus; the second joint of the flagellum the longest, slightly longer than the apical joint; emargination of the eyes deep but narrow, distance of eyes apart at posterior margin of clypeus only half their distance apart at vertex; a deep furrow from anterior ocellus to base of antennæ, the portion of the front on either side of it and just in front of anterior ocellus much raised; median furrow of median segment not conspicuous, no lateral furrows; first abdominal segment very long, slightly longer than second and third united, the two latter subequal. Black; the mandibles, base of the tibiæ, calcaria, and the tarsi more or less rufo-testaceous; pubescence silvery, very thick on clypeus and front; wings hyaline, nervures black, tegulæ testaceous; the radial cell conspicuously long.

♂ Similar, smaller, the antennæ longer, their apical joint curved and pointed; the intermediate and posterior tarsi rufo-testaceous only at the bases of the joints.

Long. 7-10 *mm.*

HABITAT: Quetta; several males and one female. The latter I found nesting in a hole in the trellis work of my verandah.

Of the Indian species the present is nearest to *T. cognatum*, but may be distinguished by the median segment being reticulate and not striate.

AMMOPHILA BOLANICA, n. sp.

♀ Head, pronotum, mesonotum, and scutellum posteriorly somewhat sparsely punctured, scutellum posteriorly finely but obscurely striate, median segment finely and regularly rugose, abdomen smooth and shining; eyes with their inner orbits nearly parallel, clypeus broader than long, arched anteriorly; posterior ocelli nearer to one another than to the margin of eyes; antennæ with the third joint the longest, but not so long as the fourth and fifth united; pronotum rather long, mesonotum with a median longitudinal line at base; median segment gradually sloping for about two-thirds of its length, then perpendicular, its posterior margin rounded; petiole short, formed of the first segment only, second segment gradually widening to apex, about the same length as the first, and rather longer than the third abdominal segment. Black; the abdomen very shining; front, scape of the antennæ, cheeks, thorax, and femora covered with long but not very dense black pubescence; legs very spinose; forewing subfuscous, hindwing rather lighter, the first discoidal nervure is received nearly in the middle of the second cubital cell.

Long. 16-17 *mm.*

HABITAT: Quetta: four specimens.

I first saw this insect in the Bolan Pass on my way to Quetta. It is allied both to *A. læta* described from Chaman, South Afghanistan, and to the European species *A. ebenina*, which extends into Persia, but it differs from both in being smaller and in the sculpture of the median segment.

AMMOPHILA FUNEREA, n. sp.

♂ Clypeus almost impunctate, vertex of head sparsely punctured, pronotum impunctate, mesonotum obliquely, scutellum and post scutellum longitudinally, and median segment transversely striate; abdomen impunctate, the first two segments shining; clypeus much produced, its anterior margin transverse, a conspicuous median longitudinal carina not reaching the anterior margin; distance of eyes apart at vertex about half as much again as at clypeus; posterior ocelli rather closer together than their distance from margin of eyes; antennæ with the second joint of the flagellum the longest, apical five joints widest in the middle; pronotum wide, not or scarcely notched; the striation of the median segment much coarser at the sides than above; petiole formed of the first abdominal segment only, second segment gradually widened towards apex, where, however, it is much narrower than the base of the third segment; legs stout, tarsal claws bidentate. Black; antennæ, abdomen, and legs pruinose; front with a very little whitish pile, cheeks and thorax in front and at the sides with a little greyish to fuscous pubescence ; wings hyaline.

Long. 23 *mm.*

HABITAT : Deesa ; a single specimen.

This species, having the tarsal claws bidentate, belongs to the subgenus Parapsammophila, of which the only other Indian representative is *A. erythrocephala.* The latter species has, however, the wings fuscous and the legs red.

SPHEX FRAGILIS, n. sp.

♀ Head and thorax with thick but rather short white pubescence, hiding the sculpturing, except on the median segment, which is finely transversely striate ; clypeus broader than long, its anterior margin rounded, with a very slight emargination in the centre ; inner margins of eyes parallel, cheeks and occiput moderately developed, mandibles very long, simple at apex ; second joint of flagellum of antennæ half as long again as the third ; pronotum rather long, mesonotum with an impressed line at base, scutellum notched, but not postscutellum ; median segment rather long, gradually sloping, rounded posteriorly, without any longitudinal furrow ; petiole of abdomen rather shorter than second and third segments united, remaining segments forming an elongated oval ; ventral plates of abdomen not pubescent or punctured ; legs long, slender, the tarsi strongly spinose, claws bidentate. Black ; the mandibles in the centre, tegulæ, second and following abdominal segments, apex of femora, tibiæ, and tarsi, rather light red ; the abdominal segments have at apex bisinuate bands of lighter colour ; many of the spines of the legs are white ; wings hyaline, nervures testaceous ; second cubital cell higher than long, rhomboidal, third much narrowed above, sub-triangular ; the first recurrent nervure is interstitial with the first transverse cubital nervure, the second recurrent nervure is received into the third cubital cell near the inner angle.

♂ Smaller, clypeus more produced, eyes very slightly divergent at vertex, all the legs, and the second and basal half of the third abdominal segments black ; the second abdominal segment with thick white pubescence.

Long. ♀ 17 *mm.* ♂ 13 *mm.*

HABITAT : Deesa ; Quetta.

This species looks like a miniature *S. nivosus*, but it is less than half the size, and differs in other respects.

SPHEX RETRACTUS, n. sp.

♂ Head and thorax with rather thick but short pubescence, which hides the sculpturing, abdomen pruinose; clypeus longer than broad, very convex, its anterior margin nearly transverse in the centre, rounded at the sides; eyes slightly divergent towards vertex, occiput and cheeks not much developed; mandibles simple, rather long and slender; second joint of flagellum of antennæ longer than third; pronotum short, not notched; scutellum notched, but not postscutellum; median segment long, gradually sloping, narrowed and rounded at apex, without a furrow, coarsely but obscurely transversely striate; petiole rather longer than the second segment, which is subequal to the third in length; ventral segments not pubescent or punctured: legs long, slender, rather feebly spined, the claws bidentate, the inner calcar of posterior tibiæ pectinated. Black; the apical margins of the abdominal segments sometimes very narrowly testaceous, the abdomen below red; pubescence and pile greyish white; wings hyaline, their apical margins very slightly infuscated.

Long. 15-17 *mm.*

HABITAT: Quetta; three specimens.

In Bingham's key this species would come next to *S. nivosus*, but it is not very nearly allied to that species. Of the European species it appears to come nearest to *S. argentulus* (Fabr.), but it is much smaller, the wings are not dark at base, and the pubescence is greyish white, not black.

PSEN REFRACTUS, n. sp.

♀ Clypeus and front with the sculpturing hidden by the pubescence, vertex of head impunctate, mesonotum finely, sparsely, and shallowly punctured, abdomen smooth and shining; clypeus broader than long, its anterior margin rounded, with a very slight incision in the centre; inner margin of eyes rounded, the width apart of eyes at vertex being slightly greater than below; antennæ inserted about the length of the third joint of the flagellum above the posterior margin of the clypeus, strongly clavate, the second joint of the flagellum half as long again as the third, front with a carina between the antennæ; cheeks strongly developed; pronotum short, below the level of the mesonotum, the latter broader than long, rounded anteriorly; median segment with a triangular portion at base depressed, the depressed portion longitudinally striate, and produced into a somewhat narrow median furrow, the sides of the median segment rounded, obscurely reticulate; petiole shorter than thorax, remainder of abdomen as long as head, thorax, and petiole united; pygidium punctured. Black; the mandibles in the centre, the second and third abdominal segments, and sometimes the margins of the remaining segments, dark red; tibiæ at base and the whole of the tarsi more or less testaceous, calcaria pale; clypeus and front covered with short, silvery pubescence; thorax, femora below, and apical two or three segments of abdomen with longer, sparse, greyish pubescence; wings hyaline, the first recurrent nervure is received into the second cubital cell before the middle, the second recurrent nervure into the third cubital cell just beyond its inner angle.

Long. 12 *mm.*

HABITAT: Mount Abu; three specimens.

This species belongs to Cameron's Annulipes group. Of the Indian species it comes next to *P. refiventris*, but can easily be distinguished from it by the petiole being shorter than the thorax, whereas in rufiventris it is as long as head and thorax united.

STIGMUS CUCULUS, n. sp. (*Dudgeon M. S.*)

"♀ Differs from *S. congruus* (Walk.) in being less than half the "size, in the whole of the antennæ being testaceous, clypeus subtrian-"gular and slightly produced; tubercles not white.

"*Long.* 3-5 *mm.*

"HABITAT: Holta, Kangra Valley.

"This small insect nests in the holes bored in soft pine by a minute "species of beetle. It stores its nest with aphidæ, and lives in colonies "of thirty or forty together. My specimens were procured from a table "in my verandah, where I had many opportunities of watching their "habits. It is much smaller than the other two Indian species of the "genus."

PASSALŒCUS DUDGEONI, n. sp.

♀ Head and mesonotum finely and closely punctured, median segment finely reticulate, abdomen impunctate or nearly so; clypeus broader than long, subtriangular, its anterior margin rounded, labrum triangular, mandibles blunt at apex; eyes divergent towards the vertex, their distance apart there being half as much again as at the base of antennæ; front without tubercles, scape of antennæ as long as the first four joints of the flagellum united, these latter joints being subequal, apical joint of flagellum the longest; mesopleuræ with a single furrow; median segment rounded posteriorly, abdomen rather longer than thorax, petiole very short. second segment the longest, second and third segments constricted at apex. Black; the scape of the antennæ, tubercles, apex of all the femora, the greater part of the tibiæ, and all the tarsi more or less yellow; the first two joints of the flagellum testaceous; wings hyaline and iridescent, nervures dark brown. tegulæ yellowish; clypeus, front, and cheeks with short, stiff, silvery pubescence.

Long. 5 *mm.*

HABITAT: Kangra Valley, Punjab, 4,500ft; two specimens sent me by Mr. G. C. Dudgeon.

This species is easily distinguished from *P. levipes* by its smaller size, and by the median segment being reticulate. It is near to *P. reticulatus* (Cam.), but has no keels on the head.

DIODONTUS TENUIS, n. sp.

♀ ♂ Head with a few scattered punctures, mesonotum and abdomen smooth and shining, median segment finely rugose; clypeus with the anterior margin rounded, with a deep notch in the centre, eyes slightly divergent towards the vertex, cheeks strongly developed; posterior ocelli further apart from one another than from the margin of eyes; antennæ short, stout, the third joint of the flagellum slightly the longest, remainder subequal; median segment narrowed and rounded posteriorly. Black; the mandibles, except their tips, the scape of the antennæ, apex of the femora, and the whole of the tibiæ and tarsi pale yellow; the flagellum of the antennæ red; clypeus and front (♂) with short, thick, silvery pubescence; wings hyaline and iridescent, nervures black, tegulæ pale testaceous.

Long. 3—3-5 *mm.*

HABITAT: Quetta; Peshin; five specimens.

Two species of this genus have been described from India by Mr. Cameron, *viz. D. geniculatus* and *D. striolatus.* From the former the present species may be distinguished by the tibiæ and tarsi being yellow: from the latter by the antennæ being red, not black. The only European species with yellow mandibles, *D. minutus* (Fabr.) has also the antennæ black.

DIODONTUS SELECTUS, n. sp.

♀ Head, thorax, and abdomen almost smooth, with a few scattered punctures, median segment finely reticulate; clypeus with three minute teeth anteriorly ; eyes with their inner orbits parallel, cheeks strongly developed, as broad as the eyes or nearly so ; anterior ocellus closer to the posterior ones than the latter are to one another ; median segment laterally with a small tubercle. Black ; the mandibles and the tibiæ and tarsi yellow, the tibiæ darker in the centre ; wings hyaline, nervures and tegulæ testaceous.

♂ Similar ; clypeus and front with silvery pubescence, flagellum of antennæ pale below, eyes divergent towards vertex.

Long. 4-5 *mm.*

HABITAT : Deesa ; Quetta ; Peshin ; six specimens.

This species is nearest to *D. geniculatus*, but may be separated from it by the lateral tubercles on the median segment.

DIODONTUS RUSTICUS n. sp.

♂ Head rather closely and coarsely punctured, the punctures on the front running into striæ, thorax sparsely punctured, median segment reticulate abdomen microscopically with minute and not very close punctures ; clypeus with the anterior margin rounded, labrum notched ; eyes divergent towards the vertex, cheeks well developed ; antennæ long, filiform, the apical joint the longest. Black ; the tibiæ and tarsi more or less pale testaceous, the latter darker in the middle ; front with thick silvery pubescence ; wings hyaline, nervures black, tegulæ pale testaceous.

Long. 5 *mm.*

HABITAT : Quetta ; Peshin ; six specimens.

The only Indian species hitherto described which has black mandibles.

GORYTES INTRUDENS, n. sp.

♀ Impunctate, or nearly so, except the scutellum and median segment, which are somewhat sparsely and shallowly punctured ; eyes convergent below, their width apart at vertex being about twice that at base of antennæ, their facetting fine and regular ; ocelli very small, the distance apart of the posterior ones being greater than their distance from the margin of eyes ; clypeus broader than long, its anterior margin produced and almost transverse ; antennæ long, filiform, inserted not much above the posterior margin of clypeus, the second joint of flagellum the longest, third and following joints gradually decreasing in length to apex ; cheeks well developed, their width being more than half the width of the eyes ; pronotum narrow, mesosternum sharply defined laterally, almost carinate; median segment gradually sloping towards apex, with a triangular sharply defined enclosed space, the latter with outwardly divergent striæ; anterior tarsi with long spines; abdomen longer than head and thorax united, first segment not petiolate, but gradually widening towards apex, where it is as wide as the base of the second segment; second segment about as long as the first, with a deep transverse furrow at base ventrally; pygidium shaped like an isosceles triangle, sparsely punctured. Dark red; the front, vertex, and apical two or three joints of the antennæ black; scutellum, postscutellum, and a broad apical band on second abdominal segment yellow; the enclosed space at the base of median segment, the femora above, a median narrow band on second, and the base of the third abdominal segments blackish; slightly pruinose, with a little sparse silver pile on clypeus and median segment; wings sub-hyaline, with a dark fuscous cloud covering the whole of the radial and the greater part of the second and third cubital cells, stigma very light testaceous, nervures testaceous, tegulæ red; the first recurrent nervure is received into the second cubital cell near the middle, the second near its outer angle; medial cell of hindwing very long, nearly twice the length of anal cell.

♂ Similar, the antennæ longer, anterior tibiæ and tarsi yellow.

Long. 8 *mm.*

HABITAT: Mount Abu; five specimens.

Having the eyes convergent below, this species would come into Bingham's key under "A," but it is not very near any of the other species in that section. Superficially it somewhat resembles *G. capitatus* (Nurse), but the yellow markings are fewer, and the eyes are much more strongly convergent below. The very small ocelli serve to distinguish it at once from *G. capitatus*, in which species the ocelli are quite three times as large as in the present species.

GORYTES IMPUDENS, n. sp.

♂ Smooth and impunctate, covered with some sparse, white pubescence; eyes with their inner margins parallel, the facetting fine and regular; ocelli large, the posterior ones distant from the margin of eyes about half as much as their width apart; clypeus very short and broad, its interior margin slightly arched; antennæ long, inserted close above the posterior margin of clypeus, apical joint the longest, curved and pointed, the three joints preceding it somewhat thickened; cheeks moderately developed; median segment with a well-defined triangular enclosed space, produced at apex into a longitudinal furrow, the enclosed space reticulate, sides of the segment well rounded; first abdominal segment not petiolate, about as long as second, the latter has no transverse ventral furrow; pygidium small, with a few punctures. Head black, the clypeus and front to just above the base of antennæ and the scape pale yellow; mandibles and flagellum of antennæ more or less red; thorax red, the enclosed space of median segment and its furrow black; abdomen black, first segment with two oval sublateral apical spots, second with an apical band much narrowed in the middle, and fifth segment pale yellowish white, ventrally entirely black; legs black, the anterior and intermediate femora red below, and the anterior tarsi reddish; a yellow or yellowish white line on all the tibiæ above; wings subhyaline, first cubital nervure received into second cubital cell just before its middle; median cell of hindwing about twice as long as anal cell.

Long. 6 *mm.*

HABITAT: Mount Abu; a single specimen.

Nearest to *G. pictus*, but may easily be distinguished from it by the absence of the fuscous patch in the forewing.

CRABRO BALUCHA, n. sp.

♀ Head finely and closely, thorax less finely, abdomen extremely, minutely and closely punctured; eyes widely divergent towards vertex, their distance apart there being at least four times that near base of antennæ; facetting of eyes not regular, being coarser towards their inner margin below; mandibles without a notch on their outer margin, bidentate at apex; clypeus much broader than long, convex in the centre, with a conspicuous longitudinal carina, its anterior margin bi-emarginate; flagellum of antennæ with all the joints subequal, first and second narrowed at base; cheeks nearly as broad as eyes; posterior ocelli about as far apart as their distance from inner margin of eyes; pronotum comparatively broad, notched in the centre, raised above the level of anterior margin of mesonotum; median segment small, somewhat narrowed posteriorly, rather steeply sloped, rugose at the sides and apex, with no enclosed space at base, but with a narrow median longitudinal furrow, which becomes slightly broader at apex; abdomen with the first segment not petiolate, but narrowed at base, becoming gradually wider towards apex, about equal in length to the second and third segments united; pygidium long, narrow, pointed, bare, with a few scattered punctures. Black; the abdomen shining; the mandibles, except their tips, the scape and the first one or two joints of the flagellum of antennæ, the pronotum, tubercles, scutellum, postscutellum, a spot on the coxæ below (frequently obsolete), all the femora, tibiæ, and tarsi, broad bands on the second, fourth, and fifth abdominal segments, and sometimes also on the third segment bright yellow; the tarsi at apex more or less inclining to ferruginous; clypeus with short, thick, silvery pubescence, remainder of head, thorax, and apical abdominal segments with short, sparse, greyish pile; wings subhyaline, nervures and tegulæ testaceous, cubital nervure received into the radial cell just before its middle.

♂ Similar; antennæ 12-jointed as in the ♀, but with joints 2-6 of the flagellum very much thickened, being about three times as wide as the scape; anterior tarsi slightly thickened, whitish; scutellum and postscutellum black, not yellow; abdomen with yellow bands on second to sixth segments, apical abdominal segment when extended smooth, emarginate at base, with stiff greyish hairs at apex.

Long. 6-8 *mm.*

HABITAT: Quetta; common.

This species belongs to the Thyreopus group, and having no enclosed space at base of median segment, it is not very near to any of the Indian species. It makes its nest in hollow reed-stems, and stores common house flies for its progeny. I saw a ♀ go into a reed-stem, which I then cut off, and bred several specimens of both sexes from it.

CRABRO PROSOPIFORMIS, n. sp.

♀ Smooth and shining, with a few scattered punctures on the head and mesonotum; eyes at vertex more than twice their width apart near base of antennæ; facetting of eyes coarser near inner margin below than elsewhere; mandibles not notched below, their apices simple; clypeus with the anterior margin produced and rounded in the middle; antennæ with the joints of flagellum subequal, not thickened; posterior ocelli much further apart from one another than from inner margin of eyes; cheeks strongly developed, nearly as wide as eyes; pronotum narrow, notched, below the level of mesonotum; median segment with a narrow triangular space at base depressed and longitudinally striate, its apex produced into a median furrow, into which two lateral furrows join; abdomen slightly longer than thorax, not petiolate, the first segment only slightly longer than the second; pygidium shaped like an isosceles triangle. Black; the mandibles, except their tips, scape of antennæ, pronotum, tubercles, scutellum usually, apex of anterior and intermediate femora, and the whole of the tibiæ and tarsi yellow; flagellum of antennæ below ferruginous, pygidium red; clypeus with rather long silvery pubescence, remainder of head, thorax, and abdomen with a little sparse, greyish pile; wings hyaline, stigma dark, nearly black; nervures dark testaceous, tegulæ light testaceous; the cubital nervure is received into the radial cell before the centre.

♂ Similar, smaller, the apical segment more blunt at apex.

Long. 4—4·5 *mm.*

HABITAT: Quetta; Peshin; fairly common.

This species belongs to the Lindenius group. In Bingham's key it would come next to *C. nanus*, from which it differs in sculpturing. It bears a strong resemblance, superficially, to a Prosopis.

CRABRO ELONGATUS, n. sp. (*Dudgeon MS*).

" ♀ Head, thorax, and abdomen smooth, the former opaque, the " latter shining; an impressed line from base of antennæ to anterior " ocellus; median segment convex, narrowed posteriorly, with some " longitudinal striæ at base, and a median longitudinal furrow; " abdomen petiolate, first segment as long as the rest of the abdomen, " very narrow, with the apex rather abruptly nodose; posterior tibiæ " dilated; clypeus with silvery pile, cheeks obscurely pilose. Black; " the scape of antennæ, anterior and intermediate tarsi, anterior tibiæ, " apex of the anterior femora, and a spot on each side of the pronotum " pale yellow.

" *Long.* 8-9 mm.

" HABITAT: Holta, Kangra Valley, 4,500ft.

" Nearest to *C. petiolatus* (Nurse), but larger, the petiole narrower " and the yellow markings as mentioned."

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES II. PART IX.

By Sir G. F. Hampson, Bart., F.Z.S., F.E.S.

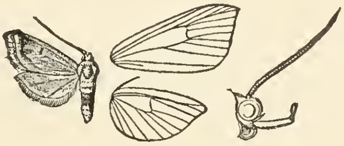
(*Continued from page 659 of Vol. XIV.*)

Moths of India—5a.

Schœnobianæ.

Genus Goniopalpia, nov.

Proboscis absent; palpi with the 2nd joint porrect and extending about twice the length of head, the 3rd upturned and dilated at extremity; maxillary palpi filiform; antennæ laminate; tibiæ with the spurs long. Forewing with vein 3 from before angle of cell; 4·5 from angle; 6 from below upper angle; 7 from angle, straight; 8·9·10 stalked; 11 free; the termen somewhat excised from apex to middle. Hindwing with veins 3 and 5 from close to angle of cell; 6·7 from upper angle, 7 anastomosing with 8; the termen strongly excised from apex to middle and again towards tornus.



Goniopalpia delicatalis ♂ $\frac{3}{2}$

4240*a*. Goniopalpia delicatalis, n. sp.

♂. White; palpi with the 1st and 2nd joints black at sides and the 3rd joint near extremity; fore tibiæ blackish above, the tarsal joints ringed with black. Forewing with the base of costal area tinged with fulvous; traces of a curved antemedial line; a slight fuscous discoidal lunule; the veins beyond the cell streaked with fulvous yellow and the interspaces suffused with fuscous; a subterminal white line from costa to vein 2, incurved at lower extremity, slightly edged by black on inner side and strongly on outer side and with some fulvous yellow suffusion beyond it; the termen yellow with fine black line on its inner side; cilia white with fine blackish line through them and the tips blackish. Hindwing with the terminal half slightly tinged with fulvous yellow.

Habitat.—Khásis. *Exp.* 14 mill. *Type*—In Coll. Rothschild.

4254*a*. Patissa fulvidorsalis, n. sp.

♂. Palpi not extending beyond the frons; silvery white; legs tinged with golden fulvous on inner side; abdomen dorsally fulvous yellow except the 1st two and terminal segments.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 36 mill. *Type*—In B. M.

4269*a*. Schœnobius aurivena, n. sp.

♂. White; palpi at sides and stripes on shoulders and legs orange. Forewing with the costa and interspaces streaked with orange; a subterminal orange line; a terminal series of orange red points; cilia orange.

Habitat.—Khásis. *Exp.* 22 mill. *Type*—In B. M.

Anerastianæ.

Genus Statina.

Statina, Rag. N. Am. Phyc. and Gall., p. 19 (1887).

Type—*S. roseotinctella*, Rag.

Range—N. and S. America; Kashmir; New Guinea.

Proboscis aborted, minute; palpi downcurved, extending about four times length of head; frons with tuft of hair; antennæ of male ciliated. Forewing with vein 2 frons towards angle of cell; 3 and 5 on a long stalk. 4 absent; 6 from below upper angle; 8·9·10 stalked; 11 from angle. Hindwing with vein 2 from close to angle of cell; 3·4 absent; 6·7 from upper angle, 8 anastomosing strongly with 7.

4275*a*. Statina cashmiralis, n. sp.

♀. Head and thorax whitish, strongly tinged with red; abdomen dorsally ochreous. Forewing ochreous-white, suffused with rufous; the median nervure and base of veins 3·5, streaked with white. Hindwing semihyaline ochreous-white.

Habitat.—Kashmir, Dras (Leech). *Exp.* 22 mill. *Type*—In B. M.

4302*b*. Saluria minutella, n. sp.

♂. Antennæ with short branches extending to near apex.

Head and thorax fuscous-grey; abdomen white, dorsally ochreous towards base. Forewing fuscous-grey; the costal area broadly whitish, extending to median nervure and vein 5 in and beyond end of cell; traces of an antemedial line and discal point. Hindwing white, slightly tinged with fuscous.

Habitat.—Deesa (Nurse); Ceylon (Pole.) *Exp.* 14 mill. *Type*—In B. M.

4314*a*. Polyocha tricoloralis, n. n.

" *variegatella*, Hmpsn., Journ., Bom. Nat. Hist. Soc., XII. p. 310, nec Rag.

Habitat.—Sikhim.

4314*a*. Polyocha variegatella, Rag. Nouv. Gen., p. 39; *id.*, Rom. Mem., VIII., pl. 36, f. 16.

♀. Head and thorax deep flesh-pink; pectus and legs paler, the fore tibiæ and tarsi streaked with white above; abdomen ochreous-white. Forewing with narrow white costal fascia, ending in a point, just before apex; the rest of wing deep flesh-pink, suffused with brown down to median nervure and vein 3; the veins with slight pale streaks. Hindwing semihyaline yellowish-white, tinged with fuscous towards costa.

Habitat.—Kangra Valley. *Exp.* 34 mill.

4315*a*. Polyocha pulverealis, n. sp.

♂. Antennæ with long uniseriate branches; forewing with veins 4·5 and 10 from cell; hindwing with veins 3·4·5 stalked.

Head, thorax and abdomen pale grey-brown, mixed with black. Forewing pale grey-brown, irrorated with black, thickly on costal half, a diffused black discoidal spot; a terminal series of points. Hindwing pale, tinged with brownish, especially towards costa; a fine terminal line.

Habitat.—Khásis. *Exp.* 30 mill. *Type*—In B. M.

2315*b*. POLYOCHA ORNATELLA, n. sp.

♂. Antennæ of male with long uniseriate branches; forewing with veins 4·5, approximated for some distance; 10 from cell; hindwing with vein 3 from cell.

Head and thorax pale yellowish-brown; abdomen ochreous. Forewing with the costal area crimson, suffused with purplish-fuscous; a white subcostal stripe ending on costa at apex; the inner area yellow with antemedial and medial crimson bands and a broad terminal band slightly tinged with grey; cilia ochreous with two crimson lines through them, dark at apex. Hind wing fuscous; cilia yellow with a dark line through their bases towards apex.

Habitat.—Kangra Valley, 4500′ (Dudgeon). *Exp.* 26 mill. *Type*—In B. M.

PHYCITINÆ.

4320*a*. HOMŒOSOMA NIMBELLA, Zell Isis, 1839, p. 178.

„ *Saxicola*, Vaughan Month. Mag., VII., p. 132 (1870).

„ *Caniusella*, Rag. Rom. Mem., VIII., p. 248, pl. 33, f. 16 (1901).

Head and thorax white, irrorated with brown; abdomen white, obscurely banded with fuscous. Forewing whitish, tinged with brown and thickly irrorated with fuscous; the area from costa to median nervure whiter to the postmedial line; an indistinct dark subbasal spot on median nervure; a curved medial series of three spots on the veins; the two discoidal points large; a rather indistinct oblique postmedial line. Hindwing semihyaline white; the veins, a fine terminal line and a line at base of cilia brownish.

Habitat.—Europe; Canaries; W. Asia; Kashmir, Dras. *Exp.* 18-24 mill.

4324*b*. HOMŒOSOMA NIGRIMEDIALIS, n. sp.

♂. Pale reddish-brown; forewing with some black irroration on costal area; a prominent black streak on median nervure and bases of veins 2·3·4; a black streak on vein 1, most prominent on medial area; slight black streaks on veins of terminal area; the lines pale, the 1st line medial, sinuous, the 2nd oblique and slightly bent inward below costa; a terminal series of black striæ. Hindwing semihyaline white; the veins and costal area fuscous; a fuscous terminal line and line through the cilia.

Habitat.—Khásis. *Exp.* 22 mill. *Type*—In Coll. Rothschild.

4325*e*. ECCOPIDIA OINISTIS, n. sp.

♀. Head, thorax and abdomen grey, irrorated with fuscous; the anal tuft fulvous. Forewing grey, irrorated with fuscous; an indistinct curved medial line interrupted at median nervure; two discoidal points; the terminal area suffused with purple-red, forming a diffused darker band. Hindwing semihyaline, tinged with brown.

Habitat.—Ceylon, Kandy (Pole). *Exp.* 16 mill. *Type*—In B. M.

4325*f*. Psorosa proleucalis, n. sp.

♂. Head and thorax ochreous ; antennæ fuscous, the tuft of scales in sinus black ; abdomen ochreous, dorsally tinged with fuscous. Forewing ochreous ; the costal area broadly white to the 2nd line and slightly irrorated with red ; the basal area suffused with fuscous to the antemedial line except on costal area and base of inner margin ; the antemedial line represented by a red spot on subcostal nervure and black spots on white patches on median nervure and vein 1 ; the discoidal black points prominent, the lower large ; the subterminal line white, rather punctiform, oblique from costa to vein 6, excurved at middle and slightly angled inwards on vein 1 ; defined on each side by an oblique black streak from apex, then by short black streak on the veins ; some white on termen and a prominent series of black points ; cilia brown with two white lines through them. Hindwing pale ochreous, the veins and costal area tinged with brown ; a fine terminal line and line at base of cilia.

Habitat.—Simla (Nurse). *Exp.* 22 mill. *Type*—In B. M.

4325*g*. Psorosa bifiliferalis, n. sp.

♂. Antennæ with slight sinus at base of shaft with scale teeth in it.

Head and thorax white ; antennæ brownish ; tarsi banded with black ; abdomen whitish, dorsally banded with black. Forewing pale brownish-ochreous, the costal half white, irrorated with brown, the costal edge blackish ; an antemedial diffused black patch on vein 1 ; an indistinct medial line ; discoidal points prominent, black, the lower largest ; postmedial line whitish, defined by diffused black on each side ; a terminal black patch with white patch on it, broad at costa, narrowing to a point at vein 1. Hindwing semihyaline white, tinged with fuscous towards termen ; a fine dark line at base of cilia.

Habitat.—Sikhim, 2000′ (Pilcher). *Exp.* 16 mill. *Type*—In B. M.

4327*a*. Heterographis hellenica, Stgr. Hor. Ent. Ross, 1870, p. 209, pl. II, f. 18.

Head, thorax and abdomen white, tinged with ochreous above. Forewing bright yellow ; the costa white, broad, rather diffused ; oblique purplish-pink sub-basal and medial bands from subcostal nervure to inner margin ; a postmedial band, with irregularly sinuous edges, bent outwards to costa, where it joins the terminal band which runs round the apex. Hindwing pale ochreous, the cilia white except at base.

Habitat.—Greece ; Syria ; Deesa. *Exp.* 16 mill.

4328*a*. Heterographis deserticola, Stgr. Stett. Ent. Zeit., 1870, p. 201 ; Rag. Rom. Mem., VIII., p. 148, pl. XXVIII., f. 17.

Head, thorax and abdomen white, tinged with pale yellow-brown above ; the 3rd joint of palpi and frontal tuft blackish in the Indian, yellowish in the European, specimens. Forewing pale yellow-brown, with white costal fascia, narrowing to apex ; slight traces of discoidal points ; the termen blackish. Hindwing hyaline white, the veins, terminal area and base of cilia tinged with brown.

Habitat.—Armenia, Sarepta ; Transcaucasia, Askabad ; Punjab, Ferozpur. *Exp.* 14-20 Mill.

4328*b*. HETEROGRAPHIS NIVEICOSTELLA, Rag. Rom. Mem., VIII., p. 149, pl. XXXIX, f. 7.

♀. Pale reddish-brown. Forewing slightly irrorated with darker scales; a white costal fascia, irrorated with brown and narrowing to apex; traces of discoidal points. Hindwing semihyaline white, the terminal half and base of cilia tinged with brown.

Habitat.—Transcaucasia, Askabad; Deesa. *Exp.* 18 mill.

4329*a*. HETEROGRAPHIS MICROSTICTELLA, n. sp.

♂. Maxillary palpi flattened against the frons.

Ochreous-white, tinged with pale rufous; abdomen white. Forewing with white costal fascia irrorated with ochreous and narrowing to apex; traces of a sinuous white antemedial line, with a fuscous point on its outer side on vein 1; the discoidal points very obscure and pale rufous; an obscure sinuous whitish subterminal line, with slight dark shade on inner side. Hindwing semihyaline white, tinged with fuscous towards termen.

Habitat.—Deesa (Nurse). *Exp.* 20 mill. *Type*—In B. M.

4329*b*. HETEROGRAPHIS FULVIMARGINELLA, n. sp.

♀. Head, thorax and abdomen whitish, marked with patches of fulvous and black scales above. Forewing whitish, thickly suffused with fulvous and black scales, leaving a white costal fascia slightly irrorated with black and narrowing to apex; an oblique dentate whitish antemedial line; the subterminal line whitish, angled inwards in discal fold and with fulvous band on outer side; cilia whitish. Hindwing semihyaline white, the veins and termen tinged with brown.

Habitat.—Deesa (Nurse). *Exp.* 24 mill. *Type*—In B. M.

4331*a*. HETEROGRAPHIS OBSCURALIS, n. sp.

Head, thorax and abdomen brownish-grey, mixed with pale grey. Forewing pale grey and grey-brown; an indistinct pale almost medial line defined by grey, excurved from below costa to submedian fold where it is slightly angled inwards; two obscure dark discoidal points; a pale subterminal line, defined on each side by grey, slightly angled inwards at vein 6, then excurved to submedian fold, where it is again angled inwards; an obscure terminal series of dark points. Hindwing pale brownish-grey; cilia white at tips.

Habitat.—Ceylon, Hambantota, Matale (Pole). *Exp.* 16 mill. *Type*—In B. M.

4332*a*. HETEROGRAPHIS CRATICULELLA, Rag. Ann. Soc. Ent. Fr., 1887, p. 251.

Antennæ of male with slight sinus at base of shaft with scale teeth in it.

♀. Head and thorax ochreous-brown, mixed with white; abdomen white dorsally, tinged with ochreous. Forewing ochreous-brown; a broad white fascia just below costa from base to near the postmedial line; an oblique white antemedial band diffused on outer side; a wedge-shaped white fascia on median nervure from beyond the antemedial band, enclosing a short brown streak at lower angle of cell and expanding towards the oblique postmedial line which expands on costa ; a white fascia on vein 1 between the ante- and postmedial lines ; an oblique white subterminal band not reaching costa towards which it expands, somewhat diffused on inner side ; all the white markings with some dark-brown scales on their edges. Hindwing semihyaline ochreous ; a fine terminal line ; cilia white with a fine line at base.

Habitat.—C. Asia, Marghilan ; Kashmir (Dras). *Exp.* 24 mill.

4341*b*. EUZOPHERODES IRRORALIS, n. sp.

Head and thorax pale brownish-ochreous ; abdomen ochreous-white. Forewing pale brownish-ochreous, irrorated with black and with black points on middle of median nervure and vein 1, at upper angle of cell and postmedial points just below costa, in discal fold and on vein 1 and a terminal series. Hindwing ochreous-white.

Habitat.—Ceylon, Hambantota, Puttalam (Pole). *Exp.* 10 mill. *Type*—In B. M.

4341*c*. EUZOPHERODES EPHESTIALIS, n. sp.

♀. Forewing with veins 3·5 from angle of cell ; 8· 9·10 stalked.

Head and thorax greyish-brown, mixed with black ; abdomen pale brown. Forewing grey-brown, irrorated with black ; the costal area black, irrorated with grey ; a black streak on base of inner margin ; a diffused black streak on vein 1 from before middle to the diffused medial black band ; discoidal points large, almost conjoined ; postmedial line strong, erect and angled outwards at middle ; an indistinct dentate subterminal line ; a terminal series of black points. Hindwing pale brown, with rather darker terminal line and line at base of cilia.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 22 mill. *Type*—In B. M.

4343*b*. EUZOPHERA ALBICOSTALIS, n. sp.

♂. Head, thorax and abdomen fuscous-brown, the head and thorax suffused with black. Forewing pale brown, thickly irrorated with fuscous ; the costal area white, tapering to a point before apex ; a whitish discoidal point and an indistinct series of dark points on termen. Hindwing pale brown, tinged with fuscous towards costa ; a fine dark terminal line and line at base of cilia.

Habitat.—Kashmir, Scind Valley (Leech). *Exp.* 26 mill. *Type*—In B. M.

4343*c*. EUZOPHERA CEDRELLA, n. sp.

Forewing with veins 4·5 and 10 from cell ; hindwing with veins 3·5 from cell.

Fuscous-brown, irrorated with grey and with a slight olive tinge. Forewing with rather narrow antemedial white band, dentate on outer side below costa and in submedian fold and bent outwards to inner margin ; a black discoidal lunule ; a more or less prominent minutely dentate white postmedial line, bent inwards below costa and outwards between veins 5 and 2 ; a terminal series of black points. Hindwing uniform golden-brown ; the cilia paler, with a brown line near base.

The larva destroys the cones of the Deodar Cedar.

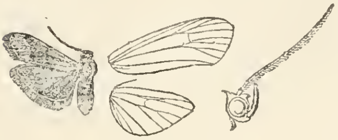
Habitat.—Simla (Pilcher) ; Punjab, Jaunsar. *Exp.* 22 mill.

Genus MESCINIA.

MESCINIA, Rag. Rom. Mem., VIII., p. 83 (1901).

Type—*M. commatella*, Zell., from Colombia.

Proboscis well developed ; palpi upturned, the 2nd joint reaching above vertex of head, the 3rd long ; antennæ ciliated. Forewing with veins 2·3 stalked, 4·5 from angle ; 6 from upper angle ; 8 and 10 stalked ; 9 absent ; 11 from cell. Hindwing with vein 2 from before angle of cell ; 3·5 stalked ; 4 absent ; 7 becoming coincident with 8.



Mescinia micans ♂ $\frac{3}{2}$.

4346. MESCINIA MICANS.

4346*a*. MESCINIA OLIVESCALIS, n. sp.

♀. Very pale olive-brown ; palpi blackish towards tips ; abdomen dorsally suffused with fuscous. Forewing irrorated with fuscous ; an obscure dark discoidal spot. Hindwing hyaline, the veins and a terminal line brown.

Habitat.—Ceylon, Kandy. *Exp.* 12 mill. *Type*—In B. M.

Sect. II. Maxillary palpi of male, minute, triangularly scaled ; frons without tuft.

4348*a*. SANDRABATIS PHÆELLA, n. sp.

♂. Head, thorax and abdomen deep fuscous-brown ; palpi in front and anal tuft ochreous. Forewing deep fuscous-brown ; a black spot on vein 1 on traces of the antemedial line ; the two discoidal black points prominent ; the postmedial line very indistinct, angled inwards below costa, outwards on vein 5 ; traces of a dentate subterminal line ; a terminal series of black points. Hindwing of pale-brown with dark terminal line and line through the cilia which are yellowish.

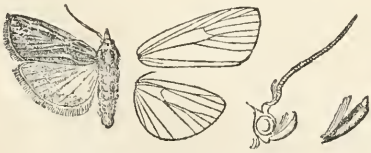
Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 28 mill. *Type*—In B. M.

Genus BLABIOIDES, nov.

Palpi upturned to above vertex of head with a hollow containing the brush-like maxillary palpi ; antennæ of male with the basal joint dilated ; the shaft laminate with a large sinus and tuft at base. Forewing long and narrow ; veins 4·5 from a point ; 8·9·10 stalked. Hindwing with the cell about one-fourth of wing ; vein 2 from angle ; 3 approximated for some distance to 4·5 which are stalked ; 7 anastomosing strongly with 8.

4348*b*. BLABIOIDES STRIGERELLA, n. sp.

♂. Head and thorax bright rufous, slightly streaked with black ; maxillary palpi ochreous ; abdomen ochreous. Forewing bright rufous, the veins streaked with blackish ; a whitish streak above median nervure ; a pale curved subcostal streak from before middle to apex ; a pale streak from inner margin near base, oblique to vein 1 along which it runs to the subterminal line which



Blabioides strigerella ♂ $\frac{3}{2}$

is oblique, angled inwards below apex and pale ; a fine dark terminal line. Hindwing pale brownish, with fine dark terminal and cilial lines.

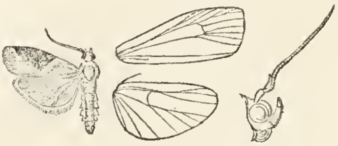
Habitat.—Ceylon, Nawalapittya. *Exp.* 20 mill. *Type*—In B. M.

Genus PTYOMAXIA, nov.

Type—*P. trigoniphora*, Hmpsn.

Range—Ceylon.

Palpi upturned, reaching just above vertex of head, the third joint well developed ; maxillary palpi small, dilated with scales, flattened against the frons ; antennæ of male laminate with large sinus and tuft at base. Forewing with costal fold ; veins 3·4·5 from angle of cell ; 8·9·10 stalked. Hindwing with the cell about one-third of wing ; vein 2 from angle ; 3·4·5 stalked ; 6·7 stalked ; 7 anastomosing with 8.



Ptyomaxia trigonifera ♂ $\frac{3}{2}$

4349*a*. PTYOMAXIA TRIGONIFERA, n. sp.

♂. Pale yellowish-brown ; antennæ with the tuft red-brown. Forewing with oblique diffused medial whitish line with large dark red-brown patch beyond it, its base on costa extending almost to apex, its apex on vein 1. Hindwing suffused with fuscous, the cilia pale.

Habitat.—Ceylon, Puttalam (J. Pole). *Exp.* 16 mill. *Type*—In B. M.

4351*a*. NEPHOPTERYX HYPOCAUTELLA, n. sp.

♂. Maxillary palpi flattened against the frons ; antennæ without sinus and tuft ; forewing with the cell on underside clothed with ferruginous red scales.

Head, thorax and abdomen clothed with white and grey-brown scales. Forewing irrorated brown and white ; a brownish-ochreous band just before middle with two tufts of vinous red scales on its inner side below the cell, with a fine white line on their inner side, a purplish spot on costa on outer edge of band ; traces of the discoidal points and of a sinuous subterminal line. Hindwing semihyaline white, the terminal half tinged with brown.

Habitat.—Deesa (Nurse). *Exp.* 14 mill. *Type*—In B. M.

4359*a*. NEPHOPTERYX RIVULELLA, Rag. Nov. Gen., p. 18 ; *id.*, Rom. Mem., VII., p. 294, pl. XLI., f. 14.

Head white ; thorax purplish-brown, mixed with white ; abdomen brown with segmental white lines. Forewing cupreous-brown with a purplish gloss ; some ochreous at base of inner margin ; the 1st line almost medial, fine sinuous and placed on a broad somewhat diffused white band ; the postmedial line very indistinct, white, sinuous. Hindwing semihyaline white, the costa and termen brown ; a brown line through the cilia.

Habitat.—W. Africa, Accra ; Deesa ; Ceylon ; Penang. *Exp.* 16 mill.

4359*b*. NEPHOPTERYX FUMOSELLA, Rag. Ann. Soc. Ent. Fr., 1887, p. 229 ; *id.*, Rom. Mem., VII., p. 246, pl. IX, f. 4.

Antennæ of male with slight sinus at base of shaft with scaly teeth in it. Head and thorax ochreous, strongly irrorated with fuscous-brown; abdomen ochreous, tinged with fuscous. Forewing ochreous-grey, strongly irrorated with fuscous-brown; the antimedial line indistinct, whitish, oblique from costa to median nervure, interrupted below cell and angled inwards on vein 1; two dark discoidal points; the subterminal line indistinct, whitish, inwardly oblique from costa to vein 5, minutely dentate on veins 5 to 2 and angled inwards in submedian fold; a terminal series of dark points. Hindwing semihyaline, tinged with pale-brown; a darker terminal line and fine line at base of cilia.

Habitat.—C. Asia, Samarkand; Kashmir, Goorais Valley. *Exp.* 30 mill.

4359*c*. NEPHOPTERYX MYRMIDONELLA, Rag. Rom. Mem., VIII., p. 103, pl. XLIV, f. 7.

Antennæ of male with a slight sinus at base of shaft with tuft of black scales in it, maxillary palpi flattened against the frons.

Head, thorax and abdomen grey-brown and white, the head and thorax irrorated with some black scales. Forewing grey-brown, with fine white streaks defining the subcostal and median nervures, the discal fold in cell and the veins beyond the medial line which have dark streaks on them; some black irroration, especially on basal half of inner area; a slightly sinuous medial yellow line defined by rough black scales, forming a large tuft on inner side below the cell; a black point at lower angle of cell. Hindwing, semihyaline white, with fine brownish terminal line, diffused inwards in female.

Habitat.—W. Africa, Old Calabar, Nigeria Borgu, E. Africa, Teita (Jackson); Deesa (Nurse); Ceylon, Puttalam (Pole). *Exp.* ♂ 14, ♀ 16 mill.

4408. PHYCITA HYEMALIS transfer to NEPHOPTERYX sect. *Palibothra* 4360*a* and re-name the species with uniseriate branches to antennæ PHYCITA MONOPECTEN, n.n.; the former occurs in Formosa, Simla, Sikhim, Ceylon and Sierra Leone, the latter in Ceylon.

4362*a*. NEPHOPTERYX (*Palibothra*) TUMIDELLA, n. sp.

Mid-femora of male with a tuft of long hair in a groove.

Head and thorax dark-brown, slightly mixed with grey; abdomen grey-brown. Forewing dark-brown, slightly irrorated with grey; the antemedial band with its inner part olive-yellow, its outer pure white and defined on each side by ridges of leaden scales; the discoidal points obliquely placed on a white patch which extends to costa and along it to the subterminal line which is white defined by dark-brown, its medial part excurved; a terminal series of black points. Hindwing semihyaline white, the veins and termen tinged with brown.

Habitat.—Ceylon, Puttalam (Pole). *Exp.* 16 mill. *Type*—In B. M.

4363*a*. NEPHOPTERYX (*Thylocoptila*) ATRISQUAMELLA, Hmpsn., Rom. Mem., VIII., p. 551, pl. 57, f. 19.

♂. Fore and hindwings with streaks of black scales below costa on underside. Head and thorax black, slightly mixed with pale-brown; abdomen grey with black subdorsal patches, the ventral surface irrorated with black. Forewing black, irrorated with leaden grey scales ; the inner and terminal areas obscurely tinged with brown ; faint traces of a black medial line and discoidal series of points ; a more distinct subterminal greyish line, defined on each side by black and excurved at middle ; a terminal series of black points. Hindwing hyaline white, the termen tinged with brown.

♀. Rather browner.

Habitat.—Ceylon, Puttalam, Matale ; Queensland, Cooktown. *Exp.* 24-26 mill.

4363*b*. NEPHOPTERYX ALBIFASCIALIS, n. sp.

♂. Legs and hindwing normal.

Head white and brown with some purple-red scales ; the brush-like maxillary palpi fulvous ; thorax and legs purplish black-brown with whitish patches on tibiæ ; abdomen brownish-ochreous, tinged with dark-brown at base and extremity. Forewing black-brown ; the inner and terminal areas mixed with grey and red-brown scales ; a pure white slightly curved fascia from below costa near base to apex. Hindwing semihyaline ochreous-white, the costa and termen tinged with brown ; cilia white, brown at base.

Habitat.—Ceylon, Matale (Pole). *Exp.* 20 mill. *Type*—In B. M.

4364*a*. NEPHOPTERYX STRIGINERVELLA, n. sp.

Palpi of male hollowed out to receive the brush-like maxillary palpi ; antennæ with slight ridge of scales at base, ending in a projecting point, the shaft serrate and fasciculate.

♂. White, with an ochreous-brown tinge ; antennæ with the shaft blackish ; palpi with dark streaks ; thorax with a few dark scales. Forewing irrorated with some red-brown scales ; an oblique antemedial series of reddish and black streaks lengthening towards inner margin and with an obscure line beyond them ; raised bosses of pale and black scales at and below lower angle of cell ; the veins of outer area streaked with dark red and black. Hindwing yellowish semihyaline white.

Habitat.—Ceylon (J. Pole). *Exp.* 18 mill. *Type*—In B. M.

4370*a*. NEPHOPTERYX RUBRALIS, n. sp.

♂. With streaks of black scales on underside below basal half of costa of forewing and subcostal nervure of hindwing.

Head and thorax ochreous, strongly tinged with red-brown ; abdomen ochreous. Forewing ochreous, tinged with red-brown, the inner and terminal areas irrorated with fuscous ; the 1st line medial, whitish, diffused, enclosing a black point on vein 1 and with diffused dark scales on its edges ; lower discoidal point prominent, black, the upper indistinct ; the 2nd line subterminal, formed of small dentate white marks on blackish streaks on the veins ; an indistinct terminal series of dark points. Hindwing yellowish-white.

♀. Head, thorax and forewing redder, the last with hardly a trace of the blackish markings.

Habitat.—Madras (Watson). *Exp.* 20 mill. *Type*—In B. M.

4370*b*. Nephopteryx calamalis, n. sp.

♂. With streaks of black scales on underside below basal half of costa of forewing and subcostal nervure of hindwing.

Head and thorax pale-ochreous, slightly irrorated with black ; abdomen ochreous. Forewing pale-ochreous, irrorated with black ; more thickly on inner and terminal areas ; the 1st line medial represented by a black point on median nervure and a black-defined whitish line from submedian fold to inner margin, angled inwards on vein 1 ; a prominent black point at lower angle of cell ; the subterminal line whitish, defined by black, angled inwards and interrupted in discal and submedian folds and minutely dentate on median nervules ; a distinct terminal series of black points. Hindwing semihyaline yellowish-white, with some fuscous suffusion on costal area ; a dark terminal line and line at base of cilia.

Habitat.—Ceylon, Puttalam (Pole). *Exp.* 20 mill. *Type*—In B. M.

4370*c*. Nephopteryx asbolalis, n. sp.

Forewing of male with patch of black scales at base of costa on underside, the anal tuft more or less black.

Head, thorax and abdomen ochreous ; palpi and fore and mid legs with patches of black ; mid and hind tibial spurs and tarsi black. Forewing ochreous, with more or less blackish suffusion on inner half and on terminal area ; the antemedial line whitish, oblique and indistinct from costa to median nervure, where there is a black point beyond it, angled inwards on vein 1, where there is a more or less developed black patch before it and black point with pale patch beyond it on its outer side ; two black discoidal points ; the subterminal line whitish defined by black, oblique from costa to vein 6 ; excurved at middle and angled inwards in submedian fold ; a terminal series of black points. Hindwing semihyaline yellowish-white, with some fuscous suffusion on costa and fine dark lines on termen and at base of cilia.

Ab. 1. Forewing with the ground color grey ; hindwing with streaks of black scales on base of costa and subcostal nervure on underside.

Habitat.—Sierra Leone (Clements) ; Simla (Pilcher) ; Deesa (Nurse) ; Belgaum (Watson) ; Bali (Doherty). *Exp.* 20 mill.

4383. Myelois pectinicornella. The larva bores in the pods of cocao in Ceylon and is very destructive.

4383*a*. Myelois ephestialis, n. sp.

Antennæ of male ciliated.

Head and thorax grey, mixed with fuscous ; tarsi with pale rings ; abdomen ochreous with fuscous dorsal bands. Forewing grey, thickly irrorated with fuscous ; an oblique antemedial black line, slightly angled outwards in submedian fold, defined by whitish on inner side and diffused on outer ; a more or less prominent dark discoidal lunule ; a pale subterminal line, defined by blackish on inner side and excurved at middle. Hindwing semihyaline, tinged with fuscous ; cilia of both wings white at base, fuscous at tips.

Habitat.—Simla (Pilcher) ; Sikhim (Dudgeon). *Exp.* 16 mill. *Type*—In B. M.

4384*a*. HYPSIPYLA PSARELLA, n. sp.

Head, thorax and abdomen grey, mixed with brown; abdomen with segmental white lines. Forewing grey, thickly irrorated with brown; an antemedial white line oblique from costa to below cell, where it is acutely angled, then angled inwards on vein 1; a dark discocellular lunule; a minutely dentate white subterminal line, slightly bent outwards at middle; a series of dark terminal points. Hindwing semihyaline white, the termen and costa tinged with fuscous.

Habitat.—Sikhim, 1800′ (Dudgeon); Puttalam, Ceylon (Pole). *Exp.* 26 mill. *Type*—In B. M.

4384*b*. HYPSIPYLA ELACHISTALIS, n. sp.

♂. Maxillary palpi dilated and flattened against frons which is conical and prominent.

Head and thorax grey, mixed with fuscous, the shoulders tinged with olive-yellow; abdomen grey. Forewing grey; the costal area tinged with olive-yellow; the basal area suffused with fuscous and vinous scales; a medial black line with an ochreous band on its inner side oblique from costa to discal fold, then erect; two fuscous and vinous discoidal points; the terminal area suffused with fuscous and vinous scales obliquely from apex to middle of inner margin; a pale subterminal line defined on each side by black and slightly bent outwards at vein 6; an ill-defined terminal series of black points. Hindwing white, tinged with fuscous; cilia of both wings with a dark line through them.

Habitat.—Ceylon, Hambantota (Pole). *Exp.* 16 mill. *Type*—In B. M.

4384*c*. HYPSIPYLA ROTUNDIPEX, n. sp. (Pl. C., f. 26.)

Antennæ of male laminate; forewing with the basal half of costa fringed with long hair, the apex rounded.

♂. Head and thorax black-brown; abdomen reddish-brown. Forewing black-brown, with rufous streaks below submedian fold and vein 1 and between veins of outer area. Hindwing semihyaline brown with a rufous tinge, the veins and fine terminal line and line through the cilia darker.

Habitat.—Sikhim, 2600′ (Pilcher). *Exp.* 36 mill. *Type*—In B. M.

4386*a*. PHYCITA HEMIPEXELLA, n. sp.

♂. Antennæ of male with large sinus and tuft; the basal half of shaft bipectinate with diminishing branches; maxillary palpi triangular, flattened against the frons.

Head, thorax and abdomen ochreous; thorax suffused with purplish-fuscous, except the front of tegulæ and shoulders; abdomen irrorated with purplish-fuscous. Forewing ochreous, the costal area and cell suffused with black, leaving an ochreous discoidal spot; a blackish antemedial patch below the cell; the postmedial line indistinct, angled beyond the cell, then very oblique and ending at vein 1; traces of a waved subterminal line; the inner area irrorated with purplish-red. Hindwing semihyaline whitish, the costal area tinged with fuscous; a fine brownish terminal line and a line through the cilia

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 18 mill. *Type*—In B. M.

4386*b*. PHYCITA PHÆELLA, n. sp.

♂. Maxillary palpi flattened against the frons; antennæ with a large sinus and tuft at base.

Head and thorax dark-brown, tinged with grey and irrorated with a few blackish scales; abdomen brown. Forewing dark-brown, suffused with grey and irrorated with blackish scales; a slight medial dark streak on vein 1, a series of postmedial streaks and some dark points on termen. Hindwing hyaline white; the fringes of hair on median nervure and base of vein 1 brown; the termen and base of cilia brown.

Habitat.—Deesa (Nurse). *Exp.* 22 mill. *Type*—In B. M.

4393. PHYCITA STENIELLA.

♂. Maxillary palpi filiform; antennæ with the basal joint dilated and angled behind, the shaft with large sinus ending with a tuft of scales.

4403*a*. PHYCITA ERYTHROLOPHIA, n. sp.

Maxillary palpi of male brush-like in hollow of labial palpi; antennæ laminate, ciliated with large hollowed out tuft at base of shaft; mid-tibiæ with fold containing a tuft of vinous hair; claspers and anal tuft very large, the latter tinged with vinous; hindwing with the base streaked with vinous scales on underside, a small hyaline streak above base of vein 2.

♂. Grey, tinged with brown; head blackish. Forewing irrorated with brown; an oblique antemedial ridge of large black scales across cell and submedian interspace; a medial whitish line, slightly defined by brown, oblique from costa to below cell where it is angled; the discoidal points black and obliquely placed; the subterminal line white, defined by brown, dentate, angled outwards on vein 6; a terminal series of black points. Hindwing semihyaline, the veins and margins brownish.

♀. Head not blackish.

Habitat.—Ceylon, Matale (Pole). *Exp.* ♂ 24, ♀ 20 mill. *Type*—In B. M.

4407*a*. PHYCITA ARDENTIA, n. sp.

♂. Head and thorax dark-rufous; abdomen pale yellow-brown. Forewing purplish red-brown; a pinkish white medial line angled inwards on vein 1 and with some purplish grey on its outer edge; a dark discoidal lunule; a whitish subterminal line obtusely angled on vein 5; a fine dark terminal line. Hindwing whitish semihyaline, the apical area tinged with fuscous; a fine dark terminal line and line through the cilia.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 20 mill. *Type*—In B. M.

4407*b*. PHYCITA OCHRALIS, n. sp.

Antennæ of male with slight sinus at base of shaft with black scale teeth in it.

♂. Head, thorax and abdomen ochreous; palpi and legs irrorated with fuscous. Forewing ochreous; the costal edge black, the costal area suffused with black and white scales towards apex; a diffused patch of rufous and black scales on inner area before middle; the cilia fuscous and white.

Hindwing semihyaline tinged with fuscous, especially on costal area; cilia white with fuscous line at base.

Habitat.—Kashmir, Goorais Valley (Leech). *Exp.* 22 mill. *Type*—In B. M.

4427*a*. CRYPTOBLABES EPHESTIALIS, n. sp.

♀. Head and thorax dark-brown; pectus, legs and abdomen grey-brown. Forewing dark-brown, the inner half suffused with red-brown; the lines represented by a few silvery grey scales. Hindwing hyaline, the veins and margins brown.

Habitat.—Ceylon, Matale (Pole). *Exp.* 14-16 mill. *Type*—In B. M.

Genus EPISCHNIA.

Epischnia. Zell. Isis 1839, p. 178.

Type—*E. prodromella,* Hübn.

Range—N. America; Europe; S. Africa; Madagascar; W. C. and N. Asia to Kashmir.

Proboscis fully developed; palpi thickly scaled, the 2nd joint oblique, the 3rd porrect; maxillary palpi dilated with hair; frons with tuft of hair; antennæ of male laminate with sinus at base of shaft, ending in some scale teeth and a slight tuft of hair; a large tuft of hair and large scales below shoulders. Forewing with veins 3·4·5 well separated; 6 from below upper angle; 8·9 stalked; 10·11 from cell. Hindwing with vein 3 approximated to 4·5, for nearly half their length; 6·7 stalked; 8 free.

4433*a*. EPISCHNIA CRETACIELLA, Mann. Ver. Zool. Bot. Wien 1869, p. 380; Rag. Rom. Mem., VII., p. 504, pl. XX., f. 1.

Head, thorax and abdomen white, tinged with pale-brown and irrorated with fuscous. Forewing white, irrorated with black and the interspaces tinged with pale-brown, the veins with streaks of black scales, defined on each side by white, the antemedial line represented by a slight oblique striga from costa and a slight striga on vein 1; a black point at lower angle of cell; traces of a postmedial line oblique from costa near apex to submedian fold where it is angled inwards; a subterminal series of short diffused streaks. Hindwing semihyaline whitish; the veins brown; the costal and terminal areas suffused with brown, especially in female; a fine terminal line and a line at base of cilia.

Habitat.—E. Europe; W. Asia; Kashmir (Dras). *Exp.* 28-30 mill.

Genus SELAGIA.

Selagia.—Hübn. Verz., p. 37 (1827).

Type—*S. argyrella,* Schiff.

Range— N. America; Europe; N. and Central Asia to Kashmir; Japan.

Proboscis fully developed; palpi thickly scaled, extending about the length of head, the 2nd joint oblique, the 3rd porrect; maxillary palpi somewhat dilated with scales; frons rounded; antennæ of male laminate, the shaft with sinus and tuft at base. Forewing with vein 3 from near angle of cell;

4·5 approximated for some distance; 6 from below upper angle; 8·9 stalked; 10·11 from cell. Hindwing with the lower angle of cell produced, vein 3 from angle, 4·5 stalked; 6·7 stalked; 8 free.

4433*b*. SELAGIA SPADICELLA—Hübn. Eur. Schmett Tin., p. 31, f. 225 (1827); Rag. Rom. Mem., VII., p. 472.

Tinea janthinella—Hübn. Eur. Schmett Tin., ff. 374-375 (1827).

Nephopteryx saltuella—Mann. Wien. Mon. 1862, p. 392.

Head and thorax rufous, mixed with fuscous and grey; legs fuscous and grey; abdomen ochreous. Forewing rufous, the costal area and veins with diffused fuscous and grey streaks; the antemedial line represented by slight dark streaks on the veins, or greyish, oblique from costa to median nervure and angled inwards on vein 1; discoidal points obscure; the postmedial line obsolete or greyish, oblique, and angled inwards in submedian fold. Hindwing semihyaline ochreous; the costal area suffused with fuscous; a fine terminal line and a line at base of cilia.

Habitat.—Europe; C. Asia; Kashmir, Goorais Valley. *Exp.* 30 mill.

4434*a*. ETIELLA GRISEA, n. sp.

♂. Head and thorax grey; maxillary palpi ochreous; abdomen whitish. Forewing pale grey, irrorated with fuscous; three obliquely placed antemedial bosses of leaden-coloured scales below the cell, with obscure yellow band beyond them, followed by dark points on median nervure and vein 1; two dark discoidal points and a diffused patch below end of cell; traces of a subterminal line excurved at middle; a fine terminal line. Hindwing yellowish semihyaline white with pale brownish terminal line.

♀. With ill-defined white subcostal fascia to forewing.

Habitat.—Ceylon, Puttalam (J. Pole). *Exp.* 18-24 mill. *Type*—In B. M.

4434*b*. ETIELLA MYOSTICTA, n. sp.

♂. Maxillary palpi filiform, slightly dilated at extremity.

Head and thorax ochreous, tinged with rufous; abdomen ochreous. Forewing ochreous, tinged with rufous, sparsely irrorated with fuscous; a fine whitish streak on median nervure; the costal area greyish, slightly defined with fuscous below; a black point at lower angle of cell; a curved postmedial series of slight blackish streaks on the veins; a terminal series of black points. Hindwing semihyaline ochreous, tinged with brown towards costa and termen; a fine terminal line and a line at base of cilia.

Habitat.—Simla (Pilcher). *Exp.* 22 mill. *Type.*—In B. M.

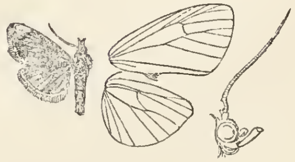
4434*c*. ETIELLA UNIFORMALIS, n. sp.

♂. Head and thorax ochreous, tinged with rufous and mixed with fuscous; abdomen ochreous. Forewing ochreous-grey, thickly irrorated and suffused with fuscous-brown; a more ochreous streak in submedian fold. Hindwing ochreous-grey, tinged with fuscous-brown.

Habitat.—Kashmir, Goorais Valley (Leech). *Exp.* 28 mill.—*Type*—In B. M

EPIPASCHIANÆ.

Genus ODONTOPASCHIA, nov.



Odontopaschia virescens ♂ $\frac{1}{1}$.

Palpi obliquely upturned, the 3rd joint porrect ; maxillary palpi strongly dilated with scales ; antennæ of male with tufts of scales at extremity of basal joint ; the shaft laminate, excised at base. Forewing with vein 3 from close to angle of cell ; 4·5 stalked ; 7·8 stalked, 9 absent ; 10 from cell ; a large tooth of scales on middle of inner margin ; tufts of large erect scales at middle of cell and on discocellulars, bearing a few long thick hairs. Hindwing with vein 3 from close to angle of cell ; 4 absent ; 7 anastomosing with 8.

4435*a*. ODONTOPASCHIA VIRESCENS, n. sp.

Head and thorax brown ; abdomen fuscous and grey. Forewing with the inner half brown, the costal half white, irrorated with green and with a large medial patch of dark-green ; the antemedial line defined by fuscous, oblique, curved above inner margin and with a patch of diffused black scales before it on inner area ; the tufts of scales in cell black and brown ; some blackish scales below end of cell ; the postmedial line dark, bent outwards at vein 5, dentate to vein 2, then excurved ; a terminal series of black points. Hindwing fuscous-brown.

Habitat.—Khásis. *Exp.* ♂ 22, ♀ 26 mill. *Type*—In B. M.

4438*c*. MACELLA RUFIBARBALIS, n. sp. (Pl. C., f. 31.)

Maxillary palpi of male free, strongly tufted with hair ; palpi with the 2nd joint very long ; a very large tuft of hair on inner side of 2nd and 3rd joints ; antennæ ciliated, the basal joint dilated ; tufts of scales behind antennæ ; hindwing with long fringes of hair on inner margin.

♂. Head, thorax and abdomen clothed with olive-green, white, pinkish and fuscous scales ; palpi whitish, dark towards extremity ; the tufts on inner side of 2nd joint red ; abdomen with some black dorsal marks, the extremity brown and black. Forewing clothed with whitish and green scales, irrorated with black ; a blackish mark at base of inner margin ; an obliquely curved antemedial black band from cell to inner margin, with some brownish suffusion on its inner side ; a tuft of brown scales in end of cell with dark mark on costa above it ; the black postmedial line oblique from costa to vein 3, then strongly incurved and dentate ; the apical area rufous ; a terminal series of black spots. Hindwing fuscous, pale towards base ; a pale subterminal mark on vein 2 ; the fringes of hair on inner area red. Underside with the apical area of forewing and whole of hindwing clothed with pale-brown scales.

♀. Much more green and fuscous with hardly any white scales ; the thorax, base and apical areas of forewing especially green ; underside purplish-fuscous with pale patches towards base of wings; the discoidal lunules distinct.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 30 mill. *Type*—In B. M.

4442*a*. Macalla plicatalis, n. sp.

♂. Palpi with the 2nd joint short, the 3rd very long and hollowed out to contain the brush-like maxillary palpi; antennæ ciliated with no tuft of scales behind them. Hindwing with the inner area dilated, forming a large fold containing rough fulvous scales on underside.

Head and thorax pale olive-brown; abdomen with the basal half yellow on dorsum, the terminal half and ventral surface ochreous, irrorated with fuscous. Forewing pale olive-brown with a thinly scaled patch on disk; some black scales on costa before middle and small tufts at middle and end of cell; an indistinct diffused dentate black line curved from costa to vein 2, then retracted to below end of cell; cilia pinkish with a series of black points. Hindwing semihyaline white; the terminal area tinged with fuscous; the inner area ochreous; cilia pinkish with a series of black points.

Habitat.—Ceylon, Matale (J. Pole). *Exp.* 32 mill. *Type*—In B. M.

4446*a*. Macalla metasarcia, n. sp. (Pl. C., f. 32.)

♀. Head and thorax ochreous, mixed with black; abdomen pinkish-ochreous, banded with black. Forewing pinkish-ochreous, almost entirely suffused with olive-black; prominent tufts of raised scales at middle and end of cell; an indistinct pale antemedial line; a postmedial line, highly excurved at middle, defined on inner sides by a black line, with a diffused pinkish-ochreous area on its inner side; a terminal series of black points; cilia pinkish with a black line through them. Hindwing flesh-color; a curved black postmedial line obsolescent towards costa and inner margin and with black spot on vein 2; a terminal band, wide at apex, tapering to a point at anal angle; cilia with a fuscous line through them.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 22 mill. *Type.*—In B. M.

4449. Macalla margarita.

♂. Palpi with the extremity of 2nd and the 3rd joint fringed with long scales, the 3rd joint curved forward into a hook; maxillary palpi triangular and flattened against the frons; vertex of head hollowed out between antennæ, with tufts of scales from above eyes meeting over vertex; antennæ with long cilia for half their length, then with short cilia.

Habitat.—Ceylon, Hambantota (J. Pole).

4453*a*. Cænodomus fumosalis, n. sp. (Pl. C., f. 30.)

Dull olive-brown and fuscous. Forewing with obscure antemedial, medial and postmedial dark bands; a streak of black and white hair in submedian fold, another streak from middle of cell to near termen and a shorter streak above vein 6, the postmedial line excurved at middle. Hindwing with medial ridge of black and white hair and streaks in the interspaces towards apex; an obscure pale postmedial line excurved and dentate at middle.

Habitat.—Khásis. *Exp.* ♂ 32, ♀ 40 mill. *Types*—In Coll. Rothschild and B. M.

4464*a*. STERICTA RUBRESCENS, n. sp.

♂. Head, thorax and abdomen olive-green, the last with segmental black lines. Forewing olive-green with black patches at base below the cell and on inner margin; a tuft of black hair in middle of cell; a medial line oblique from costa to submedian fold, where it is slightly angled; the postmedial line oblique from costa to just below vein 3, then strongly incurved; some pink suffusion beyond it and a large patch in submedian interspace towards tornus. Hindwing suffused with pink; some black suffusion at base and a patch below end of cell; the postmedial line indistinct, oblique from costa to vein 3, where it is angled; traces of a curved subterminal line.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 22 mill. *Type*—In B. M.

4464*b*. STERICTA SUSPENSALIS, Wlk. Cat. XXXIV, p. 1217.

♂. Head and thorax olive; abdomen whitish, tinged with olive; the basal segments with some black dorsal suffusion. Forewing whitish, the costal and antemedial areas tinged with olive; a blackish patch at base of inner area; traces of an antemedial white line; a prominent postmedial slightly curved white line, slightly angled inwards above inner margin, the area beyond it fuscous; the ridges of raised scales black and white. Hindwing whitish, tinged with olive before and beyond the curved postmedial line which is white defined by black on inner side towards inner margin and with black point below costa and three short streaks beyond its medial part.

In one specimen the whole hindwing is blackish to the postmedial line, and a large patch replaces the streaks beyond it.

Habitat.—Khásis; Ceylon; Borneo; Bali. *Exp.* 20 mill.

4464*c*. STERICTA OLIVIALIS, n. sp.

Antennæ of male with the basal joint dilated, but without process; maxillary palpi brush-like in fold of labial palpi.

♂. Head and thorax white and olive-green; abdomen white and olive-green with dark dorsal bands. Forewing white, thickly irrorated with olive-green; the costa with olive-green patches at base and middle; obliquely placed subbasal blackish spots below cell and on inner margin; an antemedial blackish line from cell to inner margin, interrupted at vein 1; a similar medial line angled outwards below cell, then inwards to near antemedial line; a black spot at upper angle of cell and short streaks above bases of veins 3, 4; the postmedial line dentate, oblique from costa to vein 4 and incurved in submedian interspace, defined by white on outer side, followed by a large apical olive patch and another towards tornus; a terminal series of small black spots. Hindwing whitish, tinged with brown; the terminal area fuscous; a dark terminal line and line at base of cilia.

Habitat.—Bhután (Dudgeon); Khásis. *Exp.* 30 mill. *Type*—In B. M.

4474*a*. ORTHAGA MIXTALIS, Wlk. Cat. XXVII, p. 104 (1863).

Forewing of male without glandular swelling on costa; maxillary palpi dilated with scales and flattened against the frons; antennæ with the basal joint dilated.

Head and thorax clothed with golden-green and white scales ; abdomen white and fuscous, tinged with brown towards extremity. Forewing white, irrorated and the basal area suffused with golden-green ; a more or less developed antemedial patch of black suffusion on median nervure, sometimes extending to costa and inner margin ; a curved medial black line from cell to inner margin ; a discoidal tuft of black scales ; the terminal third of wing suffused with golden-green and more or less with black, from vein 6 to inner margin extending as a broad band to inner side of postmedial line which is dentate, oblique from costa to vein 4, then somewhat inwardly oblique and angled inwards in submedian fold, defined by white on outer side ; a terminal series of black striæ. Hindwing pale fuscous-brown, with fine dark terminal line and line at base of cilia.

Habitat.—Bhután ; Borneo, Sarawak ; Java. *Exp.* 26 mill.

ON TWO CETACEANS FROM TRAVANCORE,

BY H. S. FERGUSON.

WITH A NOTE ON THE SAME,

BY R. LYDEKKER, B.A., F.R.S., F.G.S., &C.

(*With plates A & B.*)

(*Read before the Bombay Natural History Society on 5th February* 1903.)

On the 14th of February, 1901, word was brought to me that a whale had been stranded on the beach in the neighbourhood of Trivandrum. I at once sent Mr. Shankara Narayana Pillay, the head taxidermist of the Museum, with men to secure the animal and make the necessary arrangements for skinning it and obtaining its skeleton. He made the following measurements and notes on the spot:—

Length, taken in a straight line from tip of snout to the bottom of the notch in the flukes ...	16ft. 10in.
Greatest circumference	7ft. 1in.
Do. do. at genital...	6ft. 5½in.
Do. do. at anus	5ft. 6in.
Caudal fin from tip to tip	3ft. 7½in.
Dorsal fin (falcate)	2ft. 2in.
Do. vertical height...	1ft. 4in.
Flippers (falcate)	2ft. 1in.

Blow-hole on the top of the head situated a little to the left of the middle line 21 inches from the tip of the snout. Head not distinct from neck. Beak not distinct, colour smooth glistening black throughout. After skinning it, he made the following notes on the internal organs:—

Heart from root of aorta to apex	1ft. 4in.
Do. circumference	2ft. 5in.

Liver lobe (*a*) 2ft. 2in., (*b*) 2ft. 1in.

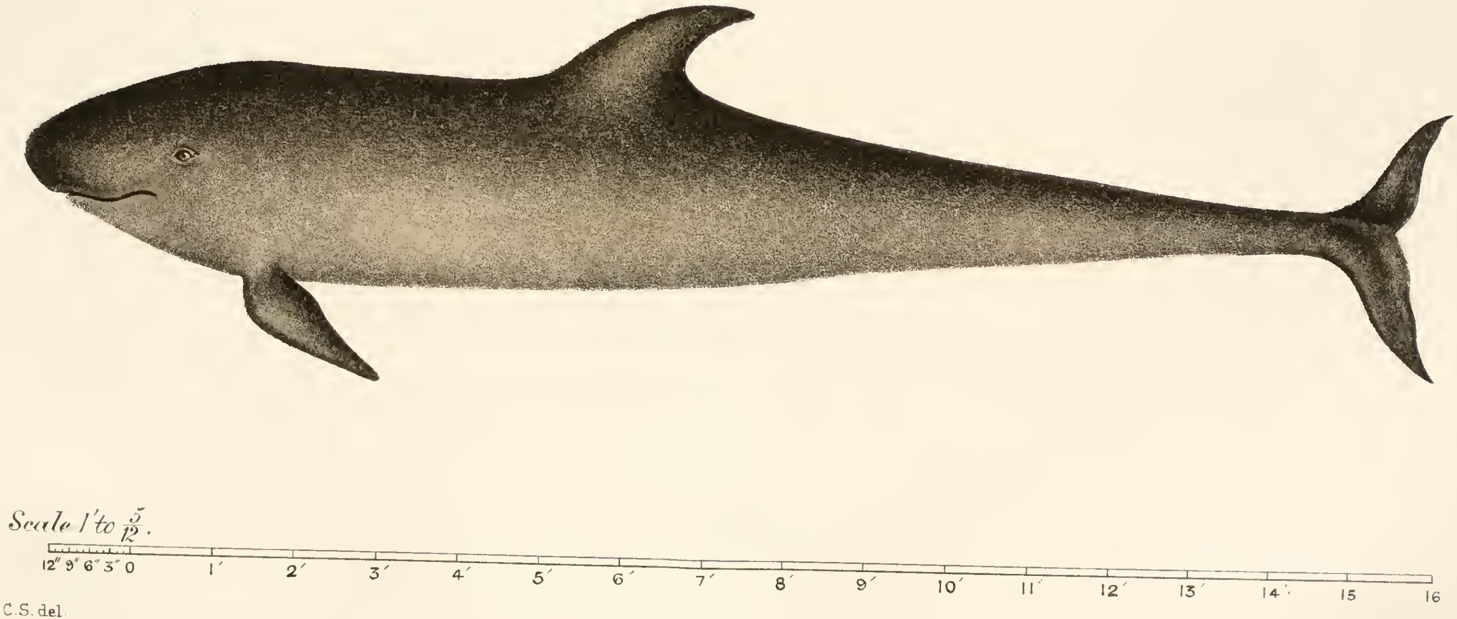
Kidneys, right 1ft. 6in., left 1ft. 2in.

Stomach resembling a wide sack 32in. long and 15in. broad.

Intestines 109ft. 4in. long.

The stomach contained two fish, one 4ft. 1in., the other 1ft. 6in. long, in a half-digested state.

To enable the skin to be set up and at the same time to retain the skeleton complete, a cast of the skull was taken and was utilised in set-


Scale 1' to 5/12.
12" 9" 6" 3" 0
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2'
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11'
12'
13'
14'
15
16

C.S. del.

PSEUDORCA CRASSIDENS.

Mintern Bros lith London.

ting up the skin instead of using the skull. Subsequent examination of the skeleton brought out the following points :—

Vertebral column.—Cervical vertebræ 7. Dorsal 10. Lumbar 10. Caudal 20.—Total 47. The first four cervicals fused together. Epiphyses fused with the centra.

Ribs 10. Sternal 6. Costal 4. All ossified, the first 6 ribs two-headed.

The sternum composed of an ossified presternum and two mesosterna, with a cartilaginous xiphisternum.

The scapula fan-shaped with the external surface concave.

Phalanges I 1, II 2, III 5, IV 7, V 1.

Skull length 1ft. 10in., breadth between the orbits 1ft. 2in.

Teeth $\frac{9}{11}$ stout, 2in. in length and from $\frac{1}{2}$ to $\frac{3}{4}$in. in diameter.

Ramis of mandible 21in., symphysis $3\frac{3}{8}$in.

Pterygoids divergent posteriorly.

The anterior portion of the premaxilla broader than that of the maxilla.

Length of rostrum taken from an imaginary line joining the angles of the mouth 1ft. 2in.

From the size of the teeth it is evident that the animal is a "Killer" or "Grampus." The only genus mentioned by Blanford is *Orca* and the only species *O. gladiator*. It differs from this in colour, in having the dorsal fin of moderate size and falcate, the pectoral fins also of moderate size and falcate, in the number of vertebræ, and the number of ribs. It approaches more nearly to the genus *Pseudorca*, a meagre description of which is given by Beddard in his Book of Whales, but differs in the number of vertebræ (not an important point however) and in the divergence of the pterygoids.

Curiously enough on the same day the fishermen brought me another cetacean, which they had that morning caught in their nets. Its description is as follows :—

Colour uniform shining black, passing gradually into a fleshy plumbeous tinge on the sides and under surface. Pectoral, dorsal and caudal fins present. Beak distinct. Lower jaw slightly longer than the upper.

Length from tip of snout to notch in centre of		caudal fin ...	8ft.	1in.
Do.	do.	to origin of pectoral fin ...	1ft.	1in.
Do.	do.	to origin of dorsal fin ...	3ft.	8in.

Length of pectoral fin which is falcate	1ft.	$3\frac{1}{2}$in.
Do. dorsal fin which is falcate...	1ft.	5in.
Height of dorsal fin	0ft.	8in.
Width of gape	1ft.	1in.
Greatest height	1ft.	$6\frac{1}{2}$in.
Do. circumference	4ft.	1in.
Smallest circumference at root of tail	0ft.	11in.

A single nasal aperture or blow hole on the top of the head. A prenaria adipose elevation marked off by a V-shape groove.

Vertebræ column.—Cervical 7, all fused together. Dorsal 13. Lumbar 17. Caudal 24.—Total 61. Epiphyses distinct. Vertebræ centra rather short. Sternum composed of presternum and two mesosterna ossified, with a cartilaginous xiphisternum.

Ribs 13. Costal 7. Sternal 6, all ossified. The first four ribs two-headed.

Phalanges I 1, II 6, III 8, IV 1, V 1. II and III well developed.

Skull.—Rostrum from anterior of the prenarial projection $4\frac{1}{2}$in.

Mandible $17\frac{3}{4}$in., symphysis barely 2in.

Teeth moderate $\frac{2\,5}{2\,5}$ and $\frac{2\,6}{2\,5}=51$. Length of skull 20in.

Breadth $8\frac{1}{2}$in. between orbits. Pterygoids not meeting in the middle line, borders divergent posteriorly.

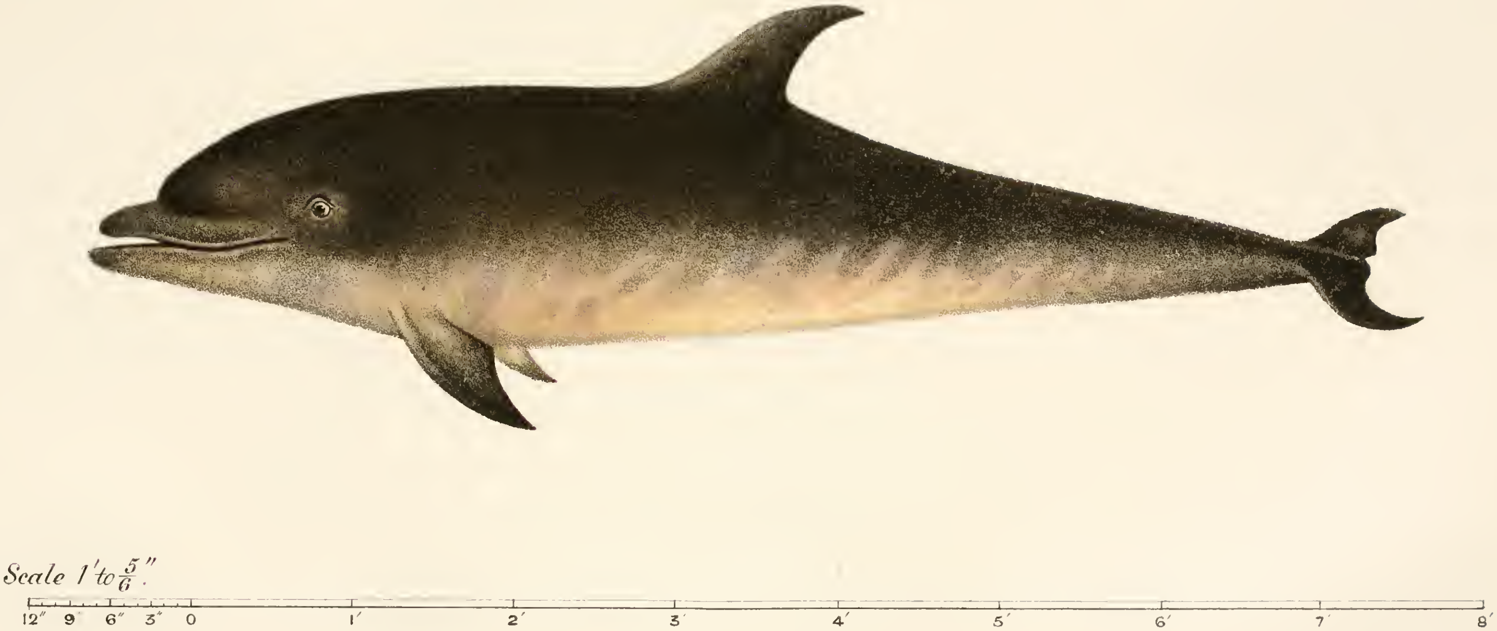
This is a slightly immature specimen. According to Blanford's synopsis of the Indian Genera, it can only belong to the genus *Tursiops*, but it differs from the genus in having the pterygoids separate, and it differs in many respects from the only species *Tursiops tursio* described by him.

NOTES ON THE TRIVANDRUM CETACEANS,

By R. LYDEKKER, B.A., F.R.S., F.G.S., &C.

The first of the two specimens referred to by Mr. Ferguson (Pl. A) is undoubtedly referable to the genus *Pseudorca*, and presents no characters by which it can be distinguished from the widely distributed False Killer (*P. crassidens*). As that species, which is new to the Indian Fauna, never appears to have been properly figured, I have thought it well to reproduce the excellent sketch sent by Mr. Ferguson. I do not attach any importance to the difference with regard to the divergence of the pterygoid bones, nor in the number of vertebræ (47 instead of 50).

Plate B.


Scale 1' to 5/6".
12" 9" 6" 3" 0
1'
2'
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C.S. del.

TURSIOPS FERGUSONI.

Mintern Bros. lith. London.

With regard to the second specimen (Pl. B), I agree with Mr. Ferguson in assigning it to the genus *Tursiops*, in spite of the fact that it differs from all the other species in the separation of the pterygoid bones of the skull. Externally it agrees with *Tursiops* in the form of the beak and fins, as well as in the general outline of the body, and the number and characters of the teeth. The number of vertebræ (61) is also that of *Tursiops* (61—64), and of no other of the allied genera.

Of the four species of *Tursiops* recognised by Mr. Truc,* the typical *T. tursio*, in addition to the united pterygoids, differs by the colour of the under-parts, which is either pale-grey or white, and the smaller number of teeth ($\frac{22}{22}$), the number of vertebræ being 64. The smaller *T. parvimanus*, of the Adriatic, in which the teeth number $\frac{25}{24}$ and the vertebræ 62, has also greyish-white under-parts. In the Australian *T. catalania* the under-parts are likewise white. On the other hand, *Tursiops abusalam* of the Red Sea comes nearer to the Trivandrum dolphin, having $\frac{26}{26}$ teeth and 61 vertebræ, and showing flesh-coloured markings mixed with green on the under-parts. The dark sea-green of the upper-parts does not, however, accord with Mr. Ferguson's description ; and there is the aforesaid difference in the pterygoids. The Pacific *T. gilli* is too imperfectly known to admit of comparison.

On the whole, I think it advisable to regard the Trivandrum dolphin as a new species of *Tursiops*, allied to *T. abusalam* (of which I have no specimens for comparison), but distinguished by the divided pterygoids, the blacker colour of the upper-parts and the more decided plumbeous flesh-colour of the under-surface, which is marked with streaks instead of spots. It may be appropriately named *T. fergusoni*.

Mr. Ferguson has promised to present the skull to the British Museum. When it arrives, I might publish a notice of its characters.

Bull. U. S. Mus., No. 36, p. 158 (1889).

A LIST OF THE BUTTERFLIES OF THE KONKAN.

By E. H. Aitken and E. Comber.

Since the first and second volumes of the Society's journal were published no attempt has been made to compile a list of our Bombay Butterflies and the references to local species in the later volumes have been few and far between. As there must be, in one way or another, a considerable number of our members who collect, or have collected, butterflies in the neighbourhood of Bombay in a more or less serious fashion, and who would be greatly assisted in their work if such a list were available for reference, we have gathered together the names, with a few short notes, of all those species that we have either personal knowledge of, or reliable information about, as occurring in the district.

One difficulty that confronted us was that of deciding as to what the limits of the local district should be, but, rejecting the idea of confining the list to those species that have been found on Bombay island itself on the ground that so large a portion of its area is now-a-days no longer suitable for the production and support of insect life, we decided to include the whole of the Konkan in the area dealt with, as being in itself a definite and characteristic district and as including most of the localities where those who attempt a collection are likely to find themselves in the field with net and killing bottle.

Taking the description of the district given by the late Mr. W. F. Sinclair in his papers on "The Waters of Western India," the Konkan may, roughly speaking, be defined as follows :—" Between the 16th and 21st degrees of North latitude (*i.e.*, from Vingorla to Surat) and between the watershed of the Sahyadri range (Western Ghats), with an average elevation of about 3,000 feet (rising in places to 4,500 ft.), and the coast." Any species found within this district may not unnaturally be expected to occur at any other *suitable* locality within its boundaries.

The list compiled by Mr. E. H. Aitken and published in the first and second volumes of our journal was based on the specimens then in the Society's collection from all parts of the Bombay Presidency with the exception of Sind and Canara. This list, besides being necessarily very incomplete, is not in the hands of many of our present local members, and is of course now largely out of date so far as the names attached to the species are concerned, owing to the constant changes that have been made since its publication, as species, previously described under new names, have been found to be only local or geographical varieties of others and as the present practice of priority in nomenclature has been carried to an extreme.

For the *Nymphalidæ* and *Lycænidæ* we have followed Marshall and de Nicèville's book and we give their reference numbers in brackets for each species. In the absence of any up-to-date list of the *Pierinæ* and *Papilioninæ* we have adopted the arrangement and nomenclature of Messrs. Bell, Davidson and Aitken's paper on the Butterflies of North Canara, which appeared in Vols. X. and XI. of our journal, in conjunction with Capt. Watson's paper in Vol. VIII. of our journal on certain genera of *Pierinæ*. In the case of the *Hesperiidæ* we follow Capt. Watson's paper in Vol. IX. of our journal.

The number of species in our list only totals 130, and there are undoubtedly many more that can be added to it, but perhaps, with the present as a basis, others will be encouraged to add their experiences by communicating to the Society additions, which have not come our way.

FAMILY—NYMPHALIDÆ.

SUB-FAMILY—DANAINÆ.

1 (16). *Danais aglea* (Cramer) [= *D. grammica* (Boisduval) in Marshall and de Nicèville].

Common at Matheran and on the hills after the rains, but not usually found below the Ghats. It has however been taken in Salsette.

2 (26). *Do.* *limniace* (Cramer). Common everywhere.

3 (28). *Do.* *chrysippus* (Linnæus). Common everywhere.

The variety or "sport," which wants the black on the apex of the forewing and has been named *D. klugii*, occurs occasionally throughout the district.

4 (31). *Do.* *genutia* (Cramer). Common everywhere.

5 (47). *Euplœa kollari* (Felder) [= *E. sinhala* (Moore) in Marshall and de Nicèville].

We took a specimen of this at Pali Hill, Salsette, in July last year. Probably fairly common throughout the district but often overlooked.

6 (61). *Do.* *core* (Cramer). Common everywhere.

7 (75). *Euplœa coreta* (Godart) [= *E. coreoides* (Moore) in Marshall and de Nicéville]. Dr. Smith includes this species in his list of Matheran butterflies, and it may be found to occur in the district.

SUB-FAMILY—SATYRINÆ.

8 (97). *Mycalesis mineus* (Linnæus). Common everywhere. The dry season form replaces the other about November.

9 (99). *Do. perseus* (Fabr:). Mr. J. A. Betham included this species in his list of Matheran Species in Vol. VIII of the Society's journal.

10 (135). *Lethe europa* (Fabr:). This species may probably be found anywhere on the hills. Mr. J. Davidson records it in the Society's journal (Vol. VIII., p. 556) at Matheran.

11 (140). *Do. neelgherriensis* (Guérin). Common on the hills before the rains, but not confined to them. It has been taken in the neighbourhood of Bombay.

12 (204).* *Ypthima philomela* (Johanssen). This species is probably often passed over, being mistaken for the next as they are indistinguishable in flight. The only definite records we have are from Andheri in Salsette and by Mr. J. A. Betham from Matheran.

13 (217). *Do. huebneri* (Kirby). Common everywhere.

14 (243). *Melanitis leda* (Linnæus). This species and its rain-season form *M. ismene* (Cramer) is common everywhere. Just after the rains in certain years they invade the whole town of Bombay in swarms and are to be seen in almost every room in the Fort.

SUB-FAMILY—ACRÆINÆ.

15 (298). *Telchinia violæ*. This is apparently not a common species everywhere; but it no doubt occurs throughout the district, and it becomes very common in some places about March.

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* Specimens marked with an asterisk will be acceptable if sent to the Bombay Natural History Society's museum.

SUB-FAMILY—NYMPHALINÆ.

16 (300). *Ergolis taprobana* (Westwood). In Marshall and de Nicèville, Major Yerbury is quoted as having taken this at Khandala. As a matter of fact it is very common there and at Matheran after the rains.

17 (301). *Do. ariadne* (Linnæus). This, if distinct from the preceding species, is only doubtfully recorded from the district. It was included by Mr. J. A. Betham in his Matheran list.

18 (303). *Byblia ilithyia* (Drury). Comparatively common at Nandurbar in the Tapti Valley after the rains and probably to be found in other suitable localities also.

19 (314). *Atella phalantha* (Drury). Common everywhere.

20 (335). *Apatura camiba* (Moore). This has been taken at Matheran, as recorded by Mr. J. Davidson in Vol. VIII of the Society's journal, and by Mr. Oliver. We have also found it at Khandala.

21 (343). *Precis iphita* (Cramer). Occurs throughout the district.

22 (344). *Junonia asterie* (Linnæus) and its dry season form *J. almana* (Linnæus). A common species, especially after the rains.

23 (347). *Do. lemonias* (Linnæus). Common throughout the district.

24 (349). *Do. hierta* (Fabr :) Common in all suitable localities.

25 (350). *Do. orithyia* (Linnæus). Common in all suitable localities.

26 (379). *Neptis lencothoe* (Cramer). This species, which for many years was known as *N. varmona* (Moore), is the common one of the genus throughout the district, being very numerous from October till February.

27 (400). *Do. ophiana* (Moore). Generally distributed throughout the district.

28 (402). *Do. jumbah* (Moore). Occurs in Salsette and at Matheran.

29 (419). *Hypolimnas bolina* (Linnæus). A common species.

30 (420). *Do. misippus* (Linnæus). Also a common species. The "*dorippus*" form of the female has been taken several times in different parts.

31 (440). *Parthenos virens* (Moore). We have seen this once at Vingorla.

32 (454). *Athyma perius* (Linnæus). Common on the ghâts and at Matheran. We know of no actual instance of it near the coast, but it may no doubt be found to occur.

33 (474). *Symphœdra nais* (Forster). This is a common species in Salsette and round about Bombay, but it does not appear to be found on the hills.

34 (513). *Euthalia garuda* (Moore). Common wherever there are mango trees about. This species is peculiarly susceptible to baits such as overripe fruit or a little toddy.

35 (517). *Do. lubentina* (Cramer). Not very rare on the hills including Matheran. It occurs occasionally in Bombay.

36 (520). *Pyrameis cardui* (Linnæus). Common in all suitable localities.

37 (544). *Cyrestis thyodamas* (Boisduval). Mr. E. H. Aitken found this "very common at Mahableshwar" during the cold weather of 1885-86. Dr. Smith includes a species of this genus as found at Matheran.

38 (556). *Kallima horsfieldii* (Kollar) [= *K. wardi* (Moore)]. Fairly common on all well-wooded hills.

39 (568). *Charaxes athamas* (Drury). Common enough on the ghâts and at Matheran.

40 (570). *Do. fabius* (Fabr :). Not so common as the preceding species, but also found on the plains. There are specimens in the Society's collection from the Tanna district.

41 (577). *Do. imna* (Butler). By no means very rare on the ghats and at Matheran.

FAMILY—LEMONIIDÆ.

Sub-Family—Libythæinæ.

42 (615). *Abisara echerius* (Stoll). After the rains very common on the hills and in the low jungles of the Tanna district. The local form was for many years distinguished as *A. fraterna* (Moore).

Sub-Family—Lycænidæ.

43 (642). *Spalgis epius* (Westwood). Not a common species, but it occurs in Bombay and Salsette and at Karanja across the harbour.

44 (673). *Chilades trochilus* (Freyer). Common enough after the rains in Bombay and the Tanna district.

45 (681). *Cyaniris puspa* (Horsfield) Occurs on the ghâts and at Matheran. We have no record of it near the coast.

46 (694). *Zizera maha* (Kollar). A very common butterfly, especially after the rains. The closely allied *Z. karsandra* (Moore) has been recorded, but all our specimens would be referred to *Z. maha.*

47 (702). *Do. gaika* (Trimen). Occurs in Bombay and Salsette.

48 (703). *Do. otis* (Fabr :). The specimens from Bombay and Salsette that we have been able to examine would no doubt be placed by some in *Z. sangra* (704) or *Z. indica* (705), but there appears to be little doubt that they are merely synonyms of *Z. otis.*

49 (712).* *Lycænesthes lycænina* (Felder). Since Mr. E. H. Aitken wrote in Vol. I of our journal that he had a strong impression that he had caught this in Bombay, we have no definite record of its occurrence.

50 (715). *Talicada nyseus* (Guerin). This peculiarly distributed species is found at Mahableshwar, sometimes in swarms at some particular spot. It occurs also at Karanja across the harbour.

51 (733). *Jamides bochus* (Cramer). Not uncommon in Bombay and Salsette, especially after the rains.

52 (738). *Lampides œlianus* (Fabr :). Very common in Bombay and Salsette and more so on the hills.

53 (743). *Catochrysops strabo* (Fabr :). This species is to be found regularly in Bombay and Salsette.

54 (745). *Do.* *enejus* (Fabr:). A commoner species than the preceding.

55 (750).* *Do.* *pandava* (Horsfield). Our only definite record of this species is from Nandurbar in the Tapti Valley, but it doubtless occurs in other parts of the district.

56 (752). *Tarucus theophrastus* (Fabr :). A common species.

57 (758). *Do.* *plinius* (Fabr :). Occurs throughout the district, but is apparently nowhere very common.

58 (759). *Castilius rosimon* (Fabr :). Very common from August to the end of the year both on the hills and the plains.

59 (766). *Do.* *decidea* (Hewitson). This is apparently not a common species. It occurs occasionally in Salsette and Matheran.

60 (767). *Polyommatus bœticus* (Linnæus). Common everywhere.

61 (775).* *Iraota timoleon* (Stoll). This is found at Matheran, and Marshall and de Nicéville mention both Khandala and Ratnagiri as places where it occurs.

62 (776). *Do.* *mœcenas* (Fabr :). There are specimens in the Society's collection from the Tanna district, and it is also found occasionally in Bombay, though it is more common on the hills than near the coast.

63 (791). *Arhopala amantes* (Hewitson). This species occurs in Salsette and also across the harbour at Karanja, in fact in all hilly jungles. Further investigation should disclose other species of this handsome genus as occurring in this district.

64 (850). *Curetis thetis* (Fabr :). Occurs regularly, probably throughout the district.

65 (890). *Zesius chrysomalius* (Hübner). Marshall and de Nicéville record this species from "Alibagh in January, and March," and also at "Hasvira Kolaba district, in January."

66 (903). *Aphnæus vulcanus* (Fabr.). Fairly numerous in Salsette and on grassy hills everywhere: also at Nandurbar in the Tapti Valley.

67 (907). *Do.* *lilacinus* (Moore). Marshall and de Nicéville record a strongly marked specimen labelled "Bombay," received from the B. N. H. Society.

68 (910). *Do.* *lohita* (Horsfield). This has been taken at Pali Hill in Salsette. Dr. Smith includes it in his Matheran list.

69 (931). *Tajuria longinus* (Fabr.). This is not a common species, but it is found in Bombay, Salsette, and also on the hills.

70 (959). *Rathinda amor* (Fabr.). Occurs almost everywhere, but is nowhere common.

71 (967). *Catapœcilma elegans* (Druce). This species has been taken at Bassein in the Tanna district and at Janjira.

72 (977). *Loxura atymnus* (Cramer). This is evidently rare. Mr. W. E. Hart recorded the capture of one "about half a mile beyond the upper end of Vehar lake" in the Society's journal (Vol. IV, p. 69) and we took one at Andheri in Salsette in September 1901.

73 (986). *Deudorix epijarbas* (Moore). This is generally distributed, but nowhere common. Mr. J. A. Betham records it at Matheran in the Society's journal (Vol. VIII, p. 423), and it is also found occasionally in Salsette.

74 (995). *Rapala schistacea* (Moore). A specimen of this species is included amongst the few of Mr. Oliver's specimens from Matheran that we have been able to examine.

75 (1006). *Do.* *melampus* (Cramer). We have found this about Bombay, but it does not seem to be common.

76 (1012). *Virachola isocrates* (Fabr.). This is common enough near the coast wherever there are pomegranate trees, in the fruit of which the larvæ feed.

77 (1013). *Do. perse* (Hewitson). This apparently is not found near the coast, but occurs on the hills. It is common at Matheran.

FAMILY.—PAPILIONIDÆ.

SUB-FAMILY—PIERINÆ.

78 *Nichitona xiphia* (Fabr.). Common everywhere.

79 *Delias eucharis* (Drury). Quite common all the year round.

80 *Catopsilia pyranthe* (Linn.). Common; sometimes to be seen in swarms.

81 *Do. crocale* (Cramer). This species, and the equally variable *C. catilla* (Cramer), which it is impossible to separate, is by no means an uncommon butter fly, especially during and after the rains, but at times for months together none are to be seen. At times too they migrate towards the south or south-west in countless numbers.

82 *Terias hecabe* (Linn.). Very common everywhere, after the rains appearing in swarms.

83 *Do. libythea* (Fabr.). This species occurs near the coast, and we have specimens from Rewa Danda, but it is apparently not by any means common, though it may often be overlooked amongst the far larger number of the other two representatives of the genus.

84 *Do. læta* (Boisduval). At times this is very common, especially during the cold weather, but at other times none are to be seen.

85 *Teracolus calais* (Cramer). The formerly recognised local species *T. cypræus* (Fabr.) has now been sunk as an inconstant variety of the above. It is an extremely local species, as it never wanders far from the food-plant of the larva (*Salvadora persica*) which is a very eccentrically distributed tree. Near the tree the butterfly generally swarms. We have no record of it from the hills.

86 *Teracolus puellaris* (Butler). This common Gujerat species occurs at the northern limits of the Konkan. We have never heard of it in the neighbourhood or south of Bombay or on the hills.

87 *Do.* *danaë* (Fabr.). This is also a local species. Col. Swinhoe took it in Bombay during a famine year, and we found it lately in great numbers on Worli Hill, Bombay. It occurs—probably more or less regularly—in the Tapti Valley, being a common Gujerat species.

88 *Do.* *eucharis* (Fabr.). Cap. Watson considers this a distinct species from the next, *viz.*,

89 *Do.* *etrida* (Boisduval). They both occur commonly in Bombay and everywhere in the district, but no doubt are to be found locally all along the coast.

90 *Ixias marianne* (Cramer). Common everywhere.

91 *Do. pyrene* (Linn.) Common everywhere.

92 *Hebemoia glancippe* (Linn.) This is a local species according as the food-plant of the larva (a kind of caper) is plentiful or not. It occurs all over the hills and is not at all uncommon in Salsette, while it has been seen occasionally in Bombay Island.

93 *Nepheronia gæa* (Felder). Quite common in Bombay and Salsette, especially after the rains, and everywhere throughout the district.

94 *Appias libythea* (Fabr.). Very common in Bombay and Salsette at times, especially before the rains.

95 *Huphina phryne* (Fabr.). This in its various seasonal forms is very common everywhere.

96 *Belenois mesentina* (Cramer). More or less common everywhere.

SUB-FAMILY—PAPILIONINÆ.

97 *Ornithoptera minos* (Cramer). Mr. E. H. Aitken records this from Karanja, across the Harbour, and also from Ratnagiri. It is probably carried great distances by the wind.

98 *Papilio hector* (Linn.). Occurs regularly about Bombay and Salsette. And also on the hills, and is very abundant in some years.

99 *Do.* *aristolochiæ* (Fabr.). Certainly more common than *P. hector*, occurring throughout the district.

100 *Do.* *agamemnon* (Linn.). Quite common all over the district, particularly about gardens.

101 *Do.* *sarpedon* (Linn.). Confined entirely to the hills, where it is common from October till the end of the year.

102* *Do.* *nomius* (Esper). In the Society's journal (Vol. I), Mr. E. H. Aitken mentioned specimens in the collection from " the ghâts which lie between the Tanna and Nasik districts." Besides this our only record is a single but unquestionable specimen observed by himself on Malabar Hill.

103 *Do.* *erithonius* (Cramer). Common everywhere.

104 *Do.* *pammon* (Linnæus). Quite common all over the district. Of the several forms of females the *polytes* type, which resembles *P. aristolochiæ*, is the commonest and the *romulus* type is not rare, but we have no record of the form that is similar to the male.

105 *Do.* *polymnestor* (Cramer). Quite common on the hills above 2,000 feet and occasionally found even in Bombay.

106 *Do.* *helenus* (Linnæus). This also occurs on the hills. It has been recognised beyond doubt by Mr. E. H. Aitken on Malabar Hill.

107 *Do.* *dissimilis* (Linnæus). This occurs in Bombay and Salsette, but is never to be seen in any numbers. It is also found at Matheran and on the ghâts.

SUB-FAMILY—HESPERIIDÆ.

108 *Celænorrhinus ambareesa* (Moore). Found all over the district in suitable localities, but especially common on the hills.

109 *Celænorrhinus leucocera* (Kollar). In Capt. Watson's book on the Indian *Hesperiidæ*, Col. Swinhoe is mentioned as having obtained this species in Bombay. We have not seen it within our limits ourselves.

110 *Sarangesa purendra* (Moore). Mr. J. A. Betham records this species in his Matheran list in the Society's journal (Vol. VIII).

111 *Do.* *dasahara* (Moore). Mr. R. C. Wroughton took this species at Bassein, Tanna district, as mentioned in the list in the Society's journal (Vol. I). We have taken it lately in Salsette.

112 *Coladenia tissa* (Moore). Mr. Aitken records two specimens taken "by Mr. R. C. Wroughton at Bansda, between the Surat and Tanna districts," in the second volume of the Society's journal.

113 *Hesperia galba* (Fabr.). This is not uncommon anywhere throughout the district.

114 *Suastus gremius* (Fabr.). Not uncommon in Bombay and Salsette. We have no record of it from the hills.

115 *Iambrix salsala* (Moore). Col. Swinhoe took this species in Bombay, and we have found it occasionally in Salsette lately.

116* *Taractrocera mævius* (Fabr.). Our only record of this species in the district is from one specimen taken last year by Mr. N. Marryat at Nandurbar in the Tapti Valley.

117 *Do.* *nicévillei.* This species, which was formerly known as *Ampittia coras* (Cramer), swarms in the grass in Bombay and Salsette during the hot weather and early part of the monsoon.

118 *Arnetta vindhiana* (Moore). To this species that formerly known as *Isoteinon nilghiriana* (Moore) is now sunk. It has been recorded by both Col. Swinhoe and Mr. Betham from Matheran.

119 *Matapa aria* (Moore). This species is probably more common than our records would appear to indicate. It is included by Dr. Smith in his Matheran list, but we have no definite instance of its occurrence since. It may be easily recognised by its bright red eyes.

120 *Gangara thyrsis* (Fabr.). About Bombay and Salsette this is by no means uncommon in certain localities, but as it does not come out till sun-down it may often be overlooked.

121 *Udaspes folus* (Cramer). This very conspicuous species is quite common in all suitable localities, including both the hills and the neighbourhood of Bombay.

122 *Telicota bambusæ* (Moore). Occurs in Bombay neighbourhood as well as on the hills, wherever bamboos grow.

123 *Baoris* (*Parnara*) *bevani* (Moore). Common about Bombay and Salsette.

124 *Do.* *do.* *guttatus* (Bremer and Grey). This species, which is closely allied to the preceding, is named by Capt. Watson as having been taken by Col. Swinhoe at Bombay.

125 *Do.* (*Chapra*) *sinensis* (Moore). [= *C. prominens*, (Moore)]. Not uncommon in Salsette, Bombay, and across the harbour.

126 *Do.* *do.* *mathias* (Fabr.). The commonest of the whole family all about the neighbourhood of Bombay, especially during the rains. The doubtfully distinct *B. agna* (Moore) has been recorded by Col. Swinhoe from Bombay.

127 *Hasora* (*Parata*) *chromus* (Cramer). Found everywhere throughout the district.

128 *Do.* *do.* *chabrona* (Fabr.). This species is recorded from Bombay by Col. Swinhoe under the name of *alexis*.

129* *Bibasis sena* (Moore). Mr. J. A. Betham records this in his Matheran list in the Society's journal (Vol. VIII.), having taken it in the "Mar-rai."

130 *Badamia exclamationis* (Fabr.). Common everywhere both on the hills and near the coast. At times hundreds may be seen migrating across the harbour at Bombay.

THE POISONOUS PLANTS OF BOMBAY.

By Lieut.-Colonel K. R. Kirtikar, I.M.S., F.L.S.,
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Civil Surgeon, Ratnagiri.

Part XX.

(With Plate V.)

(*Continued from page* 45, *Vol. XIV.*)

JATROPHA CURCAS, *Linn.*

Natural Order—Euphorbiaceæ.

Marathi :—जेपाळ=(*Jepâl*), मोगली एरंड=(*Mogli Erand*).

A large, low-branching, irregular, scraggy shrub.

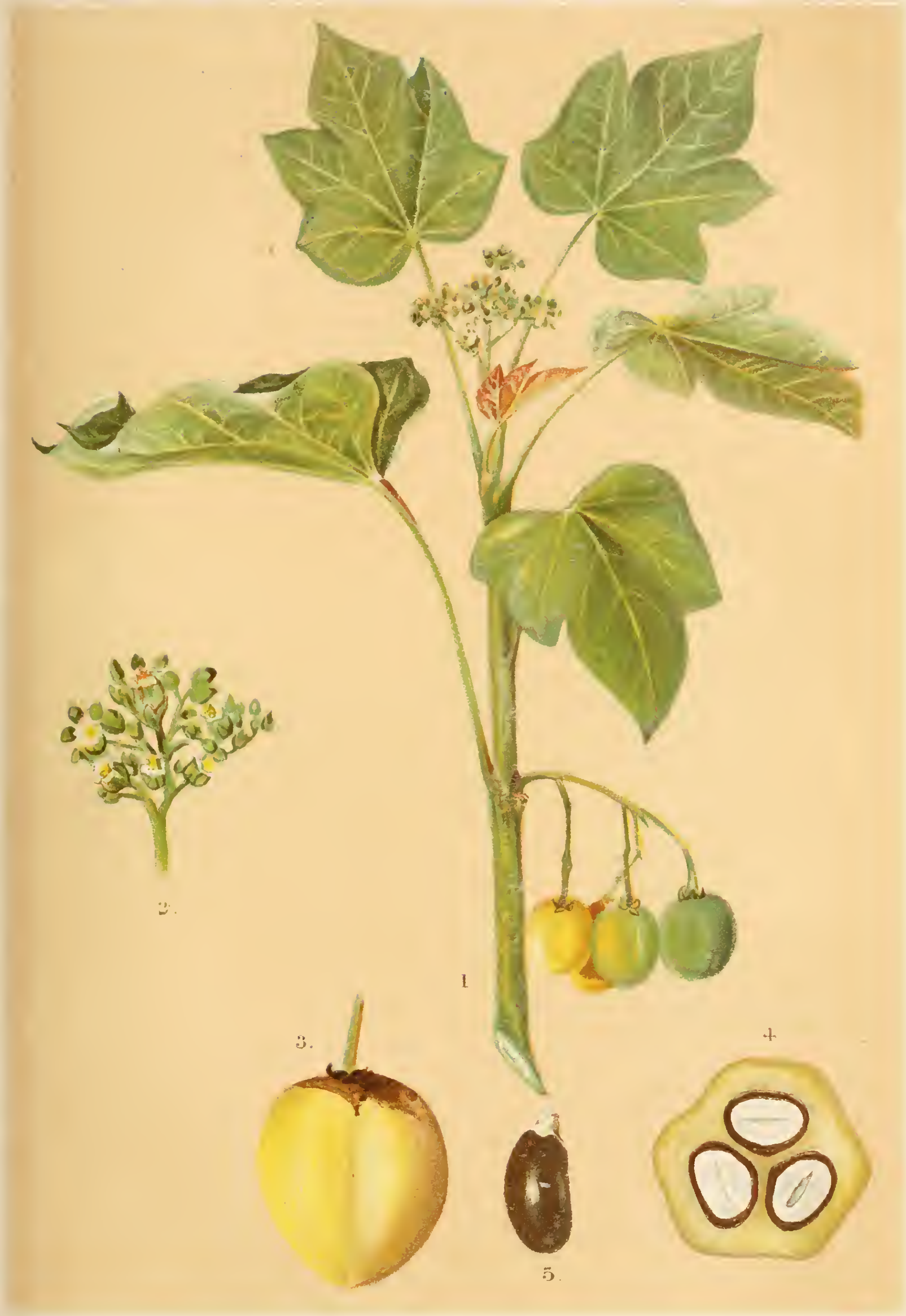
BRANCHES—irregular ; younger ones with close-packed leaves and green bark.

BARK—of older branches from one to two lines thick, light-green, covered with a thin pellucid or translucent paper-like epidermis which cracks and falls off in irregularly-shaped pieces. The bark on section with a penknife pours out copiously a thin translucent whitish juice which on exposure to air turns brown or even blood-red, and dries up in opaque tears or irregular masses. The bark of the oldest branches is light-ash-coloured, and has here and there innumerable yellowish spots of the size of a millet-seed.

WOOD—white, very soft and spongy ; pith well marked and dense in young and topmost branches. The wood, says Dymock, is loaded with starch.

LEAVES—scattered on the older branches ; closely packed at the top of youngest branches ; alternate ; the youngest leaves of a reddish tinge, with a tomentose under-surface, the tomentum disappearing as the leaf grows old and assumes a green color. Upper surface smooth. Shape broad-cordate, or orbicular-cordate ; 5-angled. Hence called "*Angular-leaved Physic-nut.*" Hooker says the leaves are 3—5 lobed, but as generally observed they are distinctly 5-lobed. Lobes 4—6 inches in diameter.

Nerves—otherwise called VEINS, well marked and prominent on the under-surface.



R.J Budhavarkar del.

Mintern Bros Chromo lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Jatropha curcas, Linn. Nat. Ord. Euphorbiaceæ

Petioles—as long as the blade ; round ; smooth ; inserted on a kidney-shaped projection of the bark and surrounded at the insertion by a thin expansion of the epidermis. Stipules absent.

INFLORESCENCE.

Flowers monœcious, yellow, or yellowish-green ; pubescent ; in terminal corymbose cymes bearing many small flowers ; the central flower in the cyme or in its forks being always female. The flowers are scentless absolutely. The peduncle is often seen arising from exterior axils. Bracts, entire small, one below each sub-division of the cyme, and generally one pressing on the calyx.

I.—MALE FLOWERS.

Found at the extremities of the ramifications of the main flower stalk, on short articulated pedicels ; deciduous.

CALYX—greenish ; sepals five, lanceolate, imbricate.

Præfloration, convoluted.

COROLLA—yellow ; $\frac{1}{4}$ inch in diameter ; petals five, ovate-oblong ; villous within. Hooker says that the corolla is salver-shaped ; Roxburgh says it is campanulate. It is the female corolla that is campanulate, as will be seen from my Plate V accompanying.

Præfloration, contorted.

STAMENS—many, says Hooker ; 8—10, says A. de Jussieu ; 6 says Roxburgh.

Filaments—connate, says Hooker. A. de Jussieu describes them thus :—" Inferiorly connate, of which 3—5 are interior and larger than the outer ones. " (Euphorbiacearum Genera, p. 37, Paris, 1824). Roxburgh, on the other hand, describes the arrangement of the filaments thus :—" Filaments *six*, the central one very thick and columnar ; the five external ones filiform, towards the base adhering to the central one ; all erect and a little longer than the calyx." The central mass of filamentous column represents the abortive Gynœcium.

Anthers—yellow ; often tinged brown. Says Roxburgh—" Ten, sagittate, equal ; five supported by the long central filament, and one by each of the others." Hooker describes the anthers as erect, 2-celled. The anther-lobes dehisce longitudinally from above downward. Anthers, says Baillon, are extrorse, dehiscing marginally. Pollen—large, spherical. Disk—always present but varies in form. It is either a yellow entire ring, or is made up of five yellow glandules or squamules " The glands of the hypogynous disk are free or united " (Baillon).

II.—FEMALE FLOWERS.

Seated in the divisions of the male pedicels, "with their own pedicels *not articulated*" (Roxb.).

CALYX—as in the male flowers, but persistent.

COROLLA—as in the male flowers, but more substantial, and distinctly companulate.

DISK—not so well-marked as that of the male flowers.

STYLES—3; bifid or bi-lobed (A. de Jussieu); short. "Connate below or united in a slender column; glabrous" (Hooker).

STIGMAS—3; bifid, pubescent.

OVARY.—3-carpelled, each carpel containing one ovule; superior· "glabrous" says Hooker. Note that the ovary and styles are said to be pubescent in Jatropha curcas of Wallich (Syn.,—J. Wightianus),—Hooker. It may be noted here that at times only one ovule, or two, mature into seed. Very seldom have I seen the three ovules yielding three seeds. But that the three ovules do so yield three seeds will be seen from my illustrative plate accompanying this paper. The ovule is pendulous from the inner angle of the central column.

FRUIT—A tricoccous capsule; oval, or globosely oblong; 1—1½ inch long; ¾ inch broad, or even 1 inch; green when first formed; yellow when mature; brownish or black when dry. Hooker says there are 2—4 cocci, but I have never seen the fourth coccus.

EXOCARP—thick and succulent; fully of milky or pellucid white juice; 2 lines thick. Black or brownish, and easily removable when dry.

ENDOCARP—"crustaceous or bony" says Hooker.

SEEDS—½—¾ inch long; ⅜ inch broad; oblong; laterally attached about the middle of the cell, with a distinct white aril at the hilum; convex on the outer or dorsal side; angular on the inner or ventral side.* There is a well-marked ridge on the ventral surface (Dymock).

TESTA—smooth, black, crustaceous.

"The *lorica* and *tegmen*," says O'Shaughnessey, "are separable. The internal *tegmen* is hard, brittle, with resinous and brownish fracture; the almond is white, foliaceous, covered with a thin white membrane." This membrane is like tissue-paper and easily separable. The almond is inodorous, of agreeable taste, but slightly acrid after chewing. It renders the saliva emulsive, and irritates the fauces (O'Shaughnessey).

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* *Footnote.*—O'Shaughnessey's Bengal Dispensatory, p. 558, Calcutta, 1841.

ALBUMEN—" Fleshy " says Hooker ; " Copious and oily " says Dymock (Pharmacographia Indica, Vol. III., p. 276, Bombay 1893). It is best to speak of the " Albumen " as *Endosperm*.

COTYLEDONS—broad ; flat ; foliaceous ; adhering closely to the large mass of endosperm. The endosperm cells contain a net-work of protoplasm saturated with oil. This oil does not exist in the form of globules or drops, though it can be extracted by pressing the endosperm-tissue as in the case of the seeds of the castor-oil plant.

RADICLE—superior, short, thick.

EMBRYO—straight, central.

GENERAL REMARKS.

Jatropha curcas is an exotic, naturalized in India. It appears to be a free and rapid grower in this country, not wanting much care. It is a hardy plant, which has taken quite kindly to the soil of Western India whether it be in the Konkan or in the Dekkan. In both these divisions of Western India, I have seen it grow profusely as a hedge-plant, where no human hand has watered it. It evidently takes its nourishment from the air, and from the soil in which it grows, depending mainly on the rain-water and dew, whenever it can get it. In the Konkan it gets its water-supply from the monsoon rains from June to October. Hooker says that the plant is ever-green. It is not so in the Konkan. I have seen that in the Thana and Ratnagiri districts it is leafless, though in inflorescence during April and May. Nay, in 1898 in Satara (Dekkan) I found the plant leafless in January and February. The plant is a native of Brazil and of the West Indies. From Brazil it is said to have been introduced here by the Portuguese (Dymock). It may be so ; it is probably introduced here from Northern Africa also, by way of Arabia. No mention appears to have been made of this plant by Henrique Van Rheede in his elaborate work entitled *Hortus Indicus Malabaricus* published at Amsterdam in 1678 in six folio volumes, fully illustrated with the aid of three local Pandits—Rango Bhat, Vinayak Pandit, and Appa Bhat. The Marâthi or *quasi-Marâthi* letter-press of the preface these three Pandits then wrote is very characteristic of the Marâthi spoken and written in Malabar in the seventeenth century.

Jatropha curcas, however, appears to have been mentioned in Bhâv-Prakash, a Sanskrit work describing several Indian plants. "Its author, Bhâv Misra," says Dattaram Chobhe, "flourished in Madras about 350 years ago." Surgeon-General Balfour of Madras says that Bhâv Misra flourished so far back as 1550 A. D. It is possible then that the Portuguese must have introduced the plant into India. Sir George Birdwood says that "Jatropha curcas was first mentioned by *Monardes*" (Veg. Products, Bombay Presidency, page 77 and page 308, 2nd ed. Bombay, 1865). *Monardes* is evidently a misprint for *Monardus*, for no such name as *Monardes* is mentioned by Professor Sachs in his History of Botany (1530—1860), published at Würzburg in 1875, and translated into English by Garnsey and Professor Balfour in 1890 (Oxford). I find, however, from John Gerarde's *Herball* that Thomas Johnson, an Apothecary of London who re-edited Gerarde's Herball in 1663 A.D., mentions an American writer named Nicolas Monardus. Johnson, in addressing his readers in a prefatory note, speaks of Nicolas Monardus as being a writer on the simple medicines of the West Indies. Evidently Monardus flourished about the middle or end of the sixteenth century. From Johnson's remarks in Gerarde, I find that the works of Monardus, originally written in Spanish, were translated into Latin by Carolus Clusius between 1583 and 1601. "Carolus Clusius," says Johnson, "was a learned, diligent, and laborious *Herbarist.*" Carolus Clusius, a Frenchman by birth, was otherwise named Charles de l'Écluse. He was born in Arras in 1526. His family suffered from religious persecution in France, and he spent the greater part of his life in Germany and the Netherlands. In 1573 he was invited to the Imperial Court of Vienna by Maximilian II. Clusius accepted the invitation and removed to Vienna. Subsequently in 1593 he became Professor of Botany in Leyden and died there in 1609 (Sachs).

O'Shaughnessey notes that Jatropha curcas is a native of New Andalusia and Havana (in the Island of Cuba). A. de Jussieu says that it is also a native of North Africa. Now, it is a well-known fact that India, especially its Western Coast, and North Africa, through Arabia, have for several centuries past been in close mercantile intercourse with each other. It is, therefore, just possible that Jatropha curcas was introduced into India by the mercantile Arab and Afric visitants of the shores of Western India. But I have no authentic information on this point. It is a mere surmise of mine. The Afric coast has given to the

Ratnagiri Coast a class of fishermen called the *Dâldis* who are distinctly of Afric blood and origin. Possibly their progenitors brought the plant with them. Why not?

In English parlance the plant is known as the *Physic-nut* or the *Purging-nut*. It must be noted that it is quite different from the plant known as *Poison-nut* which is Strychnes Nux-Vomica. The seeds of Jatropha curcas are known as *Pignons d'Inde* (Dymock). The oil obtained from the seed is spoken of as *Oleum infernale* by Professor Dr. L. Lewin of Berlin (page 374, Lehrbuch der Toxikologie, 1897). The oil is similarly spoken of by Dymock thus :—"It was formerly employed as a purgative by European physicians under the names of *Oleum Ricini majoris* and *Oleum infernale*." Roxburgh says that the plant is one of the most common on the Coromandel Coast, and in flower and fruit all throughout the year. This fact is worth noting, as showing the effects of local influences on the growth of plants. Talbot of Canara fixes a definite time for flowering and fruiting. That of flowering from April to May ; that of fruiting during the rainy season. I must note here one important remark which Roxburgh makes regarding the wood of the plant. In observing that the wood of Jatropha curcas is too soft and spongy to be of any use he cogently adds that the wood "will not even burn freely."

With regard to the oil expressed from the seeds, O'Shaughnessy and Roxburgh say that it is used to burn in lamps by the poorer classes of the natives of Bengal. I am not aware that it is used on this side of India for any such purpose. But in America it appears to be so used freely.

In noticing this plant as an exotic in his Flora of Ceylon (Vol. IV., p. 46, London 1898), Dr. Trimen says that it is very commonly planted as a fence round native gardens, and that it is a violent purgative.

Dymock says that Jatropha curcas is said to have been introduced from Brazil by the Portuguese. Sir George Birdwood gives South America as the *habitat* of the plant. The plant seems to be well-known in China, as the Chinese turn out a fine black varnish by boiling the seed-oil with Oxide of Iron. Dr. Dymock observes that the juice of the plant, when dried in the sun, forms a bright reddish-brown, brittle substance like shell-lac, which may yet be put to some useful technical purpose (Pharmacogr. Ind., Vol. III., p. 275). A similar remark is made by Dalzell and Gibson :—"The fresh juice of the stem when dried forms an elegant lac-like substance, which may yet be applied in the Arts" (p. 77, Supplement, Bombay Flora, Ed. Soc. Press, 1861).

Though the oil of the seeds of Jatropha curcas is largely used in lamps in the different parts of India mentioned above, it is known in European commerce as the "seed-oil" (G. Birdwood). No such oil that I am aware of is exported from India. So says Sir George Birdwood also.

In a work entitled "A General System of Botany" by Emm Le Maout and J. Decaisne, translated by Mrs. Hooker in 1873, London, Longmans, Green & Co., at page 698, I find the following remark which is well worthy of the consideration of Indian soap-makers. The remark runs thus :—"The seeds of Jatropha curcas [Physic-nut], a shrub growing throughout the hot countries of America, yield a plentiful supply of an oil of which soap is made."

Garcias de Orta, in his Colloquies on Indian Plants, mentions a plant named *Jatropha* (see p. 79, 2nd Edition, Lisbon, 1872). Whether it is the same as Jatropha curcas or not I am not able to determine.

The following are the SYNONYMS of Jatropha curcas, *Linn.*, as given in Hooker's Index Kewensis (pages 1251-1252, Part II, 1893, Clarendon Press, Oxford) :—

1. Jatropha acerifolia, Salisb. Prod. 389.
2. J. condor, Wall. Cat. N. 7799.
3. J. curcas, Wall. Cat. N. 7799 D=Wightiana.

Note that there is a plant called Jatropha peltata, figured by Wight in his plate 1169 in the Icones Plantarum which is the same as Jatropha Wightiana, referred to above under synonym No. 3. Note again that what Wight depicts as Jatropha villosa in plate 1159 of his Icones is said by the Compiler of the Index Kewensis to be nothing but Jatropha Wightiana. The older writers speak of this plant as Curcas purgans. Beck says it is the *Tuva tree* of the Philippine Islands. It is also known as *Indian nut.*

In a list of five hundred Indian plants published in Canarese at Mangalore by the Basel Mission Book and Tract Depository under the authorship of C. Stolz, the following synonyms are given :—

(1). Castiglionia lobata, R. B.
(2). Ricinus americanus, Mill.

(Page 11, 2nd Ed., 1891).

It may be noted here that like the leaves of the Castor-oil plant (Ricinus communis, *Linn.*) the leaves of Jatropha curcas have galactagogue properties. A decoction of the leaves is used in the Cape de Verd Islands to excite secretion of milk in women (A. A. B. in Maunder's Treasury of Botany, Part I, page 363, Edition 1870). Dr. Bennett of Sydney (Australia) is credited with having made the following observation in his work entitled *The Gatherings of a Naturalist* :—

"The milky acrid glutinous juice, when dropped on white linen, produces an indelible stain, at first of a light-blue colour, but after being washed changes to a permanent brown : it might, therefore, form a very excellent marking ink." I have not been able to obtain such a stain. Will any of my readers help me in settling this point ? The oil of Jatropha curcas seeds is said to be of a light colour, and used as a substitute for Linseed oil, as well as for dressing cloth (Maunder's Treasury of Botany). It is also said to form a basis for the red dye of the cotton fabric known as *Turkey red.*

The following remarks are made with the object of engaging the attention of those earnest students of plant-life who are interested in the investigation of the question as to how the environment of a plant in the Eastern and Western hemispheres respectively affect the existence and growth of any particular genus or species of this or that plant. It is well-known that several members of the Euphorbiaceæ, like several members of the Cactaceæ, are succulent plants. Strictly speaking, Jatropha curcas is not a succulent plant, but at all times of the year in Tropical East India, especially on the coast of Western India, in the Konkan and in the Dekkan, it is rich in a milky juice. Such plants, rich in milky juice all throughout the year, may during their existence in the hot weather be aptly compared to camels—as the "ships of the desert." Indeed, they provide for themselves a large quantity of water and are then able to dispense with further supplies for a long time without injury. "The cells of the aqueous tissue are comparatively large, and their walls thin ; the active protoplasm within forms a delicate layer round the walls—that is to say, a sac whose cavity is filled with watery, often mucilaginous fluid." These remarks of Kerner Von Marilaun's (Oliver's Translation, History of Plants, p. 328, Vol. I., 1894, London) may well apply to Jatropha curcas.

It may be noted here that the flowers of Jatropha curcas besides being odourless don't appear to be invaded by insects. Cattle wont touch its leaves. Hence as a hedge-plant it is very serviceable as already noted in my foregoing remarks. I may here emphasize the fact that Jatropha curcas is one of the Euphorbiaceous plants in which each plant without exception develops both true staminate and pistillate flowers on one and the same flower stalk. It must be further observed that the members of the Euphorbiales, not to speak of the genera only but also of the specimens of the species and varieties locally obtained, differ at times very widely in individual development of parts of the plant under local influences of soil and climate. But what I have noted above is the result of my personal observation of this plant in its living condition in Bombay, Thana, Satara, and Ratnagiri.

I have noted above that Dr. Dymock speaks of the seed of Jatropha curcas as *Pignon d'Inde.* Just a word of warning to my readers. I find from Baillon's Natural History of Plants, translated from his elaborate French work by Marcus Hartog, that there are two kinds of *Pignon d'Inde, viz.*—the large and the small. The large one is the seed of Jatropha curcas, otherwise called by Baillon as the Jatropha of Barbadoes (Castiglionia lobata, *R. et Pav.*). The small *Pignon* of India is the seed of Croton Tiglium, the oil of which is much more deadly (p. 162, Vol. V., 1878, London. Baillon's Translation into English by M. Hartog.)

From Paxton's Botanical Dictionary it appears that Jatropha curcas was introduced into England from South America in 1731. It is noted as an ever-green plant (p. 310, Edition by S. Hereman, 1868, London).

Baillon remarks that the wood of Jatropha curcas is "soft, easily decaying; palisades are however made in the Indies" (West—*K. R. K.*). Baillon further adds that Jatropha curcas is used for hedge rows in the Antilles (Marcus Hartog's English Translation of Baillon, Vol. V., p. 175).

POISONOUS PROPERTIES.

The seeds of *Jatropha curcas* are poisonous. They produce, when taken internally, vomiting and drastic purging. The oil obtained from the seeds has similar effects. "The seeds are employed by the native doctors of the Philippine Islands and considered excellent and mild purgatives in doses of from one to four seeds. The effects which result from an overdose are vomiting, purging, a burning sensation in the stomach, with a determination of blood to the head. * * * Dr. Bennett, the well-known naturalist of Sydney, has himself administered these seeds to Europeans, but has found their effects very irregular, and occasioning, in all cases, a burning sensation in the bowels followed with nausea and vomiting" [*A. A. B.* in Maunder's Treasury of Botany].

Beck says that the effects of seeds are at times so great that in addition to vomiting and purging there is insensibility, and great weakness followed by death. Violent inflammation of the mucous membrane of the stomach and intestines has also been noted (p. 832, Medical Jurisprudence, 5th Edition, London, 1836).

The following is an extract from Dr. Hilton-Fagge's Report on Toxicology and Materia Medica (p. 347, New Sydenham Society's Year-Book, 1865, London) :—" In the *Medical Times and Gazette*—(London, 1864, I. 703)—are recorded several cases of poisoning" by the seeds of *Jatropha curcas*, " which occurred at Birmingham, where three or four sacks of the nuts were sold by auction. These nuts were left on the floor, and some boys, getting access to them, put some into their pockets, and finding their taste pleasant not only ate some of them themselves, but gave others to their friends. In consequence thirty-three persons were taken so ill as to be obliged to be carried to the General Hospital. Some of them had only eaten three or four of the nuts, but others ate as many as fifty. Symptoms came on in some cases in ten minutes; in others not until two to two hours and a half had elapsed. The chief effects were pain and burning in the throat, pain and distension of the abdomen, giddiness, vomiting and drowsiness; and after an interval, purging—the evacuations being copious, mucous, and not unlike the rice-watery stools of cholera. In some cases the depression was very great; in many there was dysuria; fever was always present as an after-effect. Dilatation of the pupils was believed to exist in those who took a large quantity of the poison. It is doubtful whether the drowsiness—from which the patients were easily roused—was a narcotic effect of the nuts or whether it was caused by the great prostration." [*N.B.*—I am inclined to think the latter caused drowsiness—*K. R. K.*] Strangely enough, all the cases recovered! The treatment consisted of the administration of emetics and purgatives. Will not the Homœopaths say "*Similia similibus curantur?*"

Dr. Norman Chevers* quotes a case reported by Morrett of Salem (Madras Presidency), and fully detailed in the Madras Quarterly Journal of Medical Science, p. 37, July 1861. The case was that "of a healthy young English gentleman, who ate fifteen or twenty nuts of *Jatropha curcas*. The taste did not arouse suspicion. In an hour and-a-half burning sensations in the throat and stomach were felt, attended with great restlessness. There was profuse purging, with great pain and vomiting, by which portions of the nut were rejected. In another hour and-a-half there were severe cramps of the lower limbs. The purging now ceased. The cramps were so violent that frequently the patient sprang in agony out of bed, and stamped his feet with all his force upon the ground as if to flatten them, the cramps distorting them. The cramps affected, with less severity, the muscles of the arms, abdomen and back. Occasionally there were convulsive twitches of the back, almost like those in tetanus. He gradually became perfectly deaf. There was also impairment of sight. The pulse was very small, thready and weak. Skin cold, damp, and clammy. Features sunken and contracted. *Treatment*—Hot brandy and water, warm bath, anodyne frictions, and hot bottles. In about seven hours reaction set in and he slowly improved. Throughout the following day he remained totally deaf, and had slight cramps. Next day he was awakened by the church bell, and was quite convalescent. Although during his illness he had appeared quite conscious, he had no recollection whatever of what happened later than the profuse purging. Several other young gentlemen were in like manner affected in a less alarming degree, having taken fewer of the nuts, but in none of them was there deafness or loss of memory." In giving this long extract from Chevers my only apology is that his work is out of print now. My quotation, therefore, is likely to be of use to those who do not happen to have his work in their library.

So far as I know, the seeds of *Jatropha curcas* have never been used for criminal poisoning. Brigade-Surgeon Lyon, C.I.E., in his Medical Jurisprudence (p. 205, Ed., 1889, Calcutta) says that several cases of *accidental poisoning* are recorded. My foregoing observations will amply bear him out in his assertion.

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* Medical Jurisprudence for India, p, 275, Calcutta, 1870. Thacker, Spink & Co.

To add further evidence with regard to the poisonous nature of *Jatropha curcas* I quote Sir Robert Christison of Edinburgh. He observes that the seeds of the physic-nut of the West Indies, "when applied in the form of powder to a wound, produce violent spreading inflammation of the subcutaneous cellular tissue; and when introduced into the stomach they inflame that organ and the intestines. Four seeds will act on man as a powerful cathartic. I have known violent vomiting and purging occasioned by a few grains of the cake left after the expression of the fixed oil from the bruised seeds; and in some experiments, I performed a few years ago, I found that from twelve to fifteen drops of the oil produced exactly the same effects as an ounce of castor oil, though not with such certainty" as that of castor oil, I presume. [*K. R. K.**].

I offer to my readers the following quotation from A. S. Taylor's Medical Jurisprudence (2nd Ed., Vol. I., p. 328):—

"In August 1858, 139 children in Dublin suffered severely from eating some of these nuts, namely, of *Jatropha curcas* (*Medical Times and Gazette*, August 1858). They all recovered." * *

"M. Chevalier refers to a case in which thirty-three persons were poisoned by eating these seeds. The symptoms which they suffered from were nausea, vomiting, and general depression. Twenty were so ill that they were placed in the beds of an hospital; the remaining thirteen soon recovered."

In 1871, when a student in Grant Medical College, Bombay, I ate two seed-almonds of *Jatropha curcas* which was then growing near the Vehar water-pipe in the College garden in front of the Clock-tower. I suffered from the effects of the almonds for fully six hours, though the nuts were pleasant to eat. My friend and fellow-student Khan Bahadur Dr. K. B. Cooper, now Civil Surgeon of Shikarpur, also ate some with me. Perhaps he will remember the incident. I remember it very well, as the emesis it produced was very trying. My medical attendant, Dr. Sakharam Arjun, of sacred and loving memory, then living in the same house with me, gave me a word of warning not to play pranks with my life in the course of my botanical studies by tasting unknown plants, merely for the sake of experiment. Such foolhardiness, I know, has often destroyed valuable lives. There is a saying in Marathi जेपाळाची मात्रा ॥ वैकुंठाची यात्रा,

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* Christison's Treatise on Poisons, p. 591, 4th Edition, Edinburgh, 1845.

which means that if *jepal* is recklessly used, death is the result (Mr. G. S. Bhide, Jailor, Ratnagiri Prison).

As regards the seat of the poisonous element, O'Shaughnessy says that it is the *embryo* which is the source of the acridity of the seed and its poisonous nature. I doubt this very much. I feel almost sure, that the acridity and the poisonous principles lie in the once so-called albumen, and now called the endosperm. I do not at all believe, as suggested by O'Shaughnessy, that the removal of the little, insignificant embryo rids the nut of its poisonous property and makes it "bland and alimentary." Although this statement is made by O'Shaughnessy on the high authority of M.M. Feé and Humboldt, I must set my face humbly against it.

I find myself "all at sea" with regard to the chemical nature of the poisonous element of *Jatropha curcas.*

The active principle of the oil of *Jatropha curcas*, says Râi Bahadur Kanny Lall Dey, F.C.S. of Calcutta, has been named *Jatrophic acid.* A recent research (A. Siegel, 1894) attributes the activity of the seeds to a poisonous *toxalbumen* analogous to *Ricin* and named *Curcin* (p. 169, Indian Drugs, 2nd Edition, 1896, Calcutta). *Ricin*, says J. Charles E. Sohn, F.C.S., a member of the Society of Public Analysts of London, is a poisonous principle of castor seed of the *albuminous* kind (p. 191, Index to a Dictionary of the Active Principles of Plants, 1894, London). Dymock observes that Dr. H. Stillmark has discovered in the seeds of *Ricinus communis* an albuminoid body which has been named *Ricin*. This, however, says Dymock, does not appear to be the purgative principle (p. 277, Ph. Ind., Vol. III.). It may be noted that *Ricin* appears to have a peculiar effect on blood, causing a rapid conglomeration of the red corpuscles, together with the formation of a substance like fibrin.

The oil of *Jatropha curcas* is said to contain an active principle similar to that of the castor seeds. It is known as Ricinoleic acid. Its formula is $C_{18}H_{34}O_3$. It occurs as a glyceride in castor oil together with *tripalmatin* and tristearin. It also occurs in *Jatropha curcas*. It is a thick oily liquid which solidifies below 0° C., and mixes in every proportion with alcohol and ether. Its alcoholic solution has an acid reaction, an unpleasant persistent acrid taste, and does not oxidize in the air (Roscoe and Schorlemmer's Treatise on Chemistry, Vol. III; Organic Chemistry, Part II, p. 484, Edition, 1890, Macmillan).

I must not omit to mention here what Professor Schmiedeberg of the University of Strassburg says regarding the active principle of Castor oil. He says :—" It is soluble in the intestinal fluids only ; here alone it meets with the conditions necessary to its efficiency after it gets into the bowels. Like Croton oil, Gamboge and Jalap resin, Castor oil is insoluble in watery fluids, and consequently passes the stomach unchanged. In the intestines it is dissolved by the alkalies of the bile and pancreatic juice."* These remarks may well apply to the seed-oil of *Jatropha curcas*.

DESCRIPTION OF PLATE V.

Fig. No. 1. *Jatropha curcas*, $\frac{1}{6}$ natural size sprig with diminutive inflorescence and tender red leaf.

,, 2. Natural size inflorescence, with the companulate female flower.

,, 3. Fruit natural size.

,, 4. Transverse section of natural sized fruit with tricoccous arrangement, showing a seed in each coccus.

,, 5. Seed. Natural size, showing the white aril at the top.

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* Elements of Pharmacology, translated by Dixon of the University of Sydney, pp. 108 and 109, Edinburgh, 1887.

THE BIRDS OF THE MADHUBANI SUB-DIVISION OF THE DARBHANGA DISTRICT, TIRHUT, WITH NOTES ON SPECIES NOTICED ELSEWHERE IN THE DISTRICT.

By C. M. Inglis.

Part VI.

(*Continued from page* 771 *of Vol. XIV.*)

Order—GAVIÆ.

Family *Laridæ.*

(254) Larus ichthyaëtus.—The Great Black-headed Gull.

Blanford, No. 1489 ; *Hume,* No. 979.

A rare gull in the district. Though I heard from one of my men about a large gull several times it was not till the 18th of last December that I obtained one. A *mir-shikar* in my employ brought me a live one which had got snared in a noose at the Maiser Chaur. I kept it for several days in my water aviary, but it died. All gulls are known here as "*Kheir.*"

(255) L. ridibundus.—The Laughing Gull.

Blanford, No. 1490 ; *Hume,* No. 981.

This species is also rather rare. I have only succeeded in getting three specimens, one being in breeding plumage which was got on the 11th March. They were obtained from November to March. I have never seen more than one of this species on the same marsh.

(256) L. brunneicephalus.—The Brown-headed Gull.

Blanford, No. 1491 ; *Hume,* No. 980.

This is the common gull on the marshes in the vicinity of Baghownie and a few are also met with on the Keray River. I never came across any gulls in the sub-division though they are certain to occur on the Minti and Sumda chaurs. On the Maiser Chaur these gulls are, I believe, to be found in fair numbers throughout the cold weather. It was some time before I procured specimens, as on the marsh which I shot over they were rather wary. These gulls settle a lot on the water and nearly always where cormorants (*P. javanicus*) are feeding, and for many days my man used to hit the latter birds instead of the gulls. They seemed to have a charmed life and it was not till the 31st January 1902 that the spell was broken. All my specimens were got from November to the middle of March and none had assumed the breeding plumage. The stomachs of all the gulls I have examined have contained nothing but fish.

(257) L. cachinnans.—The Yellow-legged Herring-Gull.

Blanford, No. 1495 : *Hume*, No. 978 *bis.*

Rare. A single immature specimen was procured on the Kokoron Chaur on the 4th March 1902 and brought to me by a *mir-shikar*. He had caught it with birdlime.

Sub-family *Sterninæ.*

(258) HYDROCHELIDON HYBRIDA.—The Whiskered Tern.

Blanford, No. 1496 ; *Hume*, No. 984.

Very common. They occasionally breed here during July and August in tanks. I sent a note on their breeding here, to this Journal some time ago. Native name for all terns *Tehari.*

(259) HYDROPROGNE CASPIA.—The Caspian Tern.

Blanford, No. 1498 ; *Hume*, No. 982.

A rather scarce cold weather visitant. I have only four specimens. I got one in November, two in February and one on the 16th of March. They are rather wary birds. The one shot in November was a perfect specimen, but with no white on the lower lores. This bird, which was only wounded when hit, uttered the harsh cry as recorded by Hume.

(260) STERNA ANGLICA.—The Gull-billed Tern.

Blanford, No. 1499 ; *Hume*, No. 983.

This species is also rather scarce and is seldom seen after February. I saw one in breeding plumage on the 28th March flying over the indigo fields at Baghownie.

(261) S. SEENA.—The Indian River-Tern.

Blanford, No. 1503 ; *Hume*, No. 985.

Very common. It breeds on the sand banks of the Kamla in March and April.

(262) S. MELANOGASTER.—The Black-bellied Tern.

Blanford, No. 1504 ; *Hume*, No. 987.

Not quite as common as the former species. They breed at the same time and place as *seena.*

(263) S. FULIGINOSA.—The Sooty Tern.

Blanford, No. 1514 ; *Hume*, No. 992 *bis.*

I have nothing further to add to my note on this species already sent to our Journal.

Sub-family *Rhynchopinæ.*

(264) RHYNCHOPS ALBICOLLIS.—The Indian Scissors-bill.

Blanford, No. 1517 ; *Hume*, No. 995.

Rather scarce. A few are however generally seen on the banks of the Kamla near Jainagar during July and August.

ORDER STEGANOPODES.

Family *Pelecanidæ.*

(265) PELECANUS ROSEUS.—The Eastern White Pelican.

Blanford, No. 1520 ; *Hume*, No. 1003.

A fine female caught by a *mir-shikar* with birdlime in the Benoa Chaur on the 17th July 1901. It was alone preening its feathers near the edge of the water. This is the only one that either I or my men have ever seen in the district. Native name *Ganggoya.*

(266) PELECANUS ONOCROTALUS.—The Roseate Pelican.

Blandford, No. 1521 ; *Hume*, No. 1001.

I have just received on the 17th March a female of this species or rather what I should say was intermediate between *onocrotalus* and *roseus*. It is a fine bird very deeply suffused with pink. It has got the 24 rectrices of *onocrotalus* but the bill is too small for that species, being only 14″·8. The frontal region is also much swollen. The measurements taken in the flesh are as follows:—*length*, 63″·5 ; *wing*, 27″ ; *tail*, 7″·5 ; *tarsus*, 5″ ; *bill at gape*, 14″·8 and *expanse* 108″·25. A female of *roseus* was also brought in from the same place, *viz.*, the Maiser Chaur. Native name *Jalasind*.

(267) PELECANUS PHILIPPENSIS.—The Spotted-billed Pelican.

Blanford, No. 1523 ; *Hume*, No. 1004.

Rather common. This species is met with from the end of June to the beginning of October. They frequent tanks, rivers and marshes.

Native name *Koorair*.

Family *Phalacrocoracidæ*.

(268) PHALACROCORAX CARBO—The Large Cormorant.

Blanford, No. 1526 ; *Hume*, No. 1005.

Not very common, only found during the cold weather. I have never seen many together, but Mr. Scroope wrote me that he had seen considerable numbers at Awari on the 21st February. Native names *Gandil and Kurruk*.

(269) P. FUSCICOLLIS.—The Indian Shag.

Blanford, No. 1527 ; *Hume*, No. 1006.

This species is, I believe, to be obtained on the Maiser Chaur. The *mir-shikars* know it well and say they have seen it there. Native name *Ganowli*.

(270) P. JAVANICUS.—The Little Cormorant.

Blanford, No. 1528 ; *Hume*, No. 1007.

Uncommon in the north of the district but common elsewhere. I have never found it breeding, though I have seen it all the year round near Baghownie. Near that Factory and about the end of July a large number frequented a piece of water near which there were some mango trees. I hoped they would breed, but they left the neighbourhood without doing so. I am certain they must breed somewhere near here. Native name *Ghogur*.

Sub-family *Plotinæ*.

(271) PLOTUS MELANOGASTER.—The Indian Darter.

Blanford, No. 1529 ; *Hume*, No. 1008.

Mr. Scroope met this species near Jhanjiarpur and Mamgachi, at the latter place on the 9th January. I have never come across it, but received specimens snared by a *mir-shikar* somewhere in the district. Native name *Banwa*.

ORDER—HERODIONES.

Sub-order PLATALEÆ.

Family *Ibididæ.*

(272) IBIS MELANOCEPHALA.—The White Ibis.

Blanford, No. 1541; *Hume,* No. 941.

Scarce in the sub-division except near Minti, where a flock of about fifty was seen in February. The 27th May is the latest date on which I have got this species; a fine male in breeding plumage being secured on that date. The testes were greatly enlarged. The skin of the wing in the young bird is fleshy. I have not found this species breeding here. Native name *Hasoo dabil.*

(273) INOCOTIS PAPILLOSUS.—The Black Ibis.

Blanford, No. 1542; *Hume,* No. 942.

Very common. I have taken eggs from March to August. A pair commenced building on the 23rd September, but deserted the nest. Most of the nests were on Simul (*Bombax sp.*), generally single, though I have found two nests close to each other. One nest with two fresh eggs was found on a pipal (*F. religiosa*). It was an old nest of *O. calvus,* but the Ibises had lined it with mango leaves and grass. This is called the "Planter's Friend" by many Europeans on account of the number of crickets they kill in the indigo fields; some people also call it the curlew. Native name *Karánkal.*

(274) PLEGADIS FALCINELLUS.—The Glossy Ibis.

Blanford, No. 1544; *Hume,* No. 943.

I never came across this species in the sub-division, but it is fairly common at some distance from Baghownie, on the Chilwara Chaur from March to May. I have not found it breeding here. The head is the last to change into breeding plumage. I have a bird with the back and wings in breeding plumage, and also getting some chestnut feathers in the lower plumage, but the head is in winter plumage. Native name *Kávaira.*

Family *Plataleidæ.*

(275) PLATALEA LEUCORODIA.—The Spoonbill.

Blanford, No. 1545; *Hume,* No. 939.

I have seen few spoonbills near Jainagar and Narhar, but Scroope saw a big flock containing 42 birds at Kolwahi, a village a few miles from Narhar. One of my men says he saw about a couple of hundred on the Minti Chaur in February. I have got specimens from November to the middle of April. Native name *Koorpia dabil.*

Sub-order CICONIÆ.

Family *Ciconiidæ.*

(276) CICONIA ALBA.—The White Stork.

Blanford, No. 1546; *Hume,* No. 919.

Very common during the cold weather. They arrive about the end of October and remain to the end of March. Numbers are snared by the *mirshikar* with birdlime. Sometimes they are very tame and I have shot them dead with No. 6 shot. Native names *Ghybur* and *Burra Relwa.*

(277) C. NIGRA.—The Black Stork.

Blanford, No. 1547 ; *Hume*, No. 918.

A scarce winter visitant. They also remain till March. My men generally come across one or two every cold weather and have several times fired at them but never succeeded in getting one yet. Once I had a shot at one as it flew over my bungalow at Narhar but it was rather far off for the cartridges I had. I think this is the species the *mir-shikars* call *Mullaik* but cannot be certain till they bring me one in.

(278) DISSURA EPISCOPUS.—The White-necked Stork.

Blanford, No. 1548 ; *Hume*, No. 920.

Very common. Simul trees are the favourite sites for their nests ; one nest was taken on a pipal. Usually only a single nest is found on the one tree but I have found two touching each other. The earliest nest with eggs was taken on the 15th July, and the latest on the 28th October. They do lay earlier, as a female shot by Mr. G. Dalgliesh on the 3rd June had in the oviduct an egg ready for ejection. This bird had a nest on the tree on which she was shot ; on going there a month later I found the cock-bird had paired again. I took some young in down from a nest on the 15th August. Feathers commenced to appear on the head, back and wings on the 20th, and by the 13th September the whole body was covered with them. These birds had perfect liberty and flew away on the 8th October. Most of the day they rested on their tarsus and when about to be fed used to emit a peculiar gutteral sound which seemed to come from far down in the throat. A young bird whilst feeding in a field at Narhar began to stagger and fell. There was some *seet* water in the field and it must have imbibed some of this which evidently had an intoxicating effect on it. Native names *Lag lag* and *Retwa.*

(279) XENORHYNCHUS ASIATICUS.—The Black-necked Stork.

Blanford, No. 1549 ; *Hume*, No. 917.

I have found this species decidedly rare here, but Mr. G. Dalgliesh writes in the *Zoologist* " a not uncommon resident." I got one, a young female at Narhar in December 1898, and Mr. Scroope sent me the following note on the 19th January 1900 :—" What interested me beyond anything was the discovery of the black-necked stork at the latter place (Kachara). I got quite close to a pair which were wading . . . . I saw several huge storks at Minti also which I feel sure were this species." Some *mir-shikars* saw some at the Benoa Chaur about the end of July but failed to snare any. I have a couple of fine adult birds got in August. Native name *Loha sarang.*

(280) LEPTOPTILUS DUBIUS.—The Adjutant.

Blanford, No. 1550 ; *Hume*, No. 915.

Rather scarce. They arrive in June and I have seen them up to December, one being brought me on the 21st of that month. It is very seldom, however, that they are seen so late as that. I do not think they breed here and the late birds probably go to the Gorakhpur District, The *mir-shikars* snare them in nooses fastened on small but strong bamboo pegs which are stuck in the ground. The nooses, which are all close together, are put down on three sides near where the bird is feeding and the men gradually make it edge up to them. If it steps into them well and good, if not they take them up and put them down further on. It is generally a very lengthy proceeding but that is immaterial to the native. Mahomedans eat its flesh. A fine male measured 60½ inches in length, had a pouch of 14″ and a wing expanse of 8′·11″. Native name *Garur.*

(281) L. JAVANICUS.—The Smaller Adjutant.

Blanford, No. 1551 ; *Hume*, No. 916.

On the 24th November I saw a pair feeding in some shallow water at Narhar. I got another one in the Darbhanga District on the 8th June 1902. I have also heard this species make the same guttural noise as *D. episcopus.* Native name *Chandiari.*

(382) PSEUDOTANTALUS LEUCOCEPHALUS.—The Painted Stork.

Blanford, No. 1552 ; *Hume*, No. 938.

I only obtained a single specimen in the sub-division but got numbers, both young and adults, brought me at Baghownie by *mir-shikars* from May to September. Native name *Kankarri.*

(283) ANASTOMUS OSCITANS.—The Open-bill.

Blanford, No. 1553; *Hume*, No. 940.

I once missed one in a tank near Jainagar in December 1896. I saw none in 1897, 1898 and 1899. One of my men came across a flock of about 125 at Minti in February 1900. I have got them from October to June but have never seen any during the other months. I do not think they breed with us. A few are in the white plumage by April but the majority seem to assume it in the following month. Native name *Dokar.*

Sub-order ARDEÆ.

Family *Ardeidæ.*

(284) ARDEA MANILLENSIS.—The Eastern Purple Heron.

Blanford, No. 1554 ; *Hume*, No. 924.

I have not found this species common here and have only got one adult. Some, most of them young birds, are to be seen on most of the chaurs. Native name *Khyra.*

(285) A. CINEREA.—The Common Heron.

Blanford, No. 1555 ; *Hume*, No. 923.

This is a common species. I have noticed them up to May but doubt whether they breed with us. I have a falcon which flies at this species and brings them down in nice style. On the ground he fastens on to the neck just below the head and the heron appears to be quite helpless. Native name *Kabud.*

(286) HERODIAS ALBA.—The Large Egret.

Blanford, No. 1559 ; *Hume*, Nos. 924 *bis* & 925.

This is the only egret I have personally seen in this district. I have always found them most wary. A very fine specimen in breeding plumage was brought me from Fureckeer in the Monghyr District on the 11th March. It measured, *length to end of train* 47″; *wing* 17″; tail 7″·5: *tarsus* 8″·5; *bill at gape*, 6″ 5; *expanse* 67″. *Bill* yellow with tip dusky; *legs and feet* black, *tibia* greenish. Three specimens all in full breeding dress had the bills yellow, though Blanford gives it as black in that plumage. Another one also in breeding plumage brought me measured, *length* 36″·5; *wing* 14″·25; tail 5″6; *tarsus* 7″; *bill at gape* 5″·5; *expanse* 54″·2. The larger ones the *mir-shikars* call *Mallang bogla* and the smaller ones *Torra bogla.* They find no difficulty in distinguishing the two varieties, but I have seen too few to form an opinion as to whether they are two species or one.

(287) H. INTERMEDIA.—The Smaller Egret.

Blanford, No. 1560; *Hume*, No. 926.

A dozen or so of this species have been brought in to me by *mir-shikars* but none in breeding plumage. Native name *Patokha bogla.*

(288) HERODIAS GARZETTA.—The Little Egret.

Blanford, No. 1561; *Hume*, No. 927.

Mr. G. Dalgliesh saw a bird of this species in full breeding plumage at Dulsing Serai in August 1900. Three or four have been brought to me by *mir-shikars.* A couple brought from Fureckeer were in breeding plumage. One a fine male measured—length 26″; *wing* 11″; *tail* 4″; *tarsus* 4″·2; *bill at gape* 4″4; *expanse* 41″. *Bill* black with base of lower mandible flesh colour tinged with green; *facial* skin greenish-yellow; *iris* yellow; *tarsus* black; *toes* dirty-yellow. The dorsal feathers of this species are most valuable. According to the *mir-shikars* they sell from Rs. 8 to Rs. 15 per tola and those of *alba* and *intermedia* from Rs. 8 to Rs. 10. Native name *Karchia bogla.*

(289) BUBULCUS COROMANDUS.—The Cattle Egret.

Blanford, No. 1562; *Hume*, No. 929.

Very common. I have found them breeding here in August. In one colony which was breeding there were quite as many birds in winter plumage as in the other dress. They assume the breeding plumage in April. Native name *Surkhia bogla.*

(290) LEPTERODIUS ASHA.—The Indian Reef-Heron.

Blanford, No. 1563; *Hume*, No. 928.

A male of this species in the dark plumage, but without the crest, was brought me to-day, the 25th March, from the Benoa Chaur. It was, according to the *mir-shikar* who brought it, the only one of its kind and was feeding with other egrets. The colours of the soft parts were :—*bill* reddish-yellow, base of maxilla brown and of lower mandible yellowish-green and flesh colour; *orbital skin* dull-green and yellow round the orbits; *iris* golden-yellow; *tibia* brown also *just below the knee* on one leg and the *greater portion of the tarsus* of the other leg of the same colour; *remainder of tarsus* of both legs yellowish-green; *toes* reddish-yellow above and dirty-yellow beneath. Native name *Kala karchia.*

(291) ARDEOLA GRAYI.—The Pond Heron.

Blanford, No. 1565 ; *Hume*, No. 930.

Exceedingly common. This is the well known "Paddy bird." They breed here from April to September. They commence to assume their breeding plumage in March. Native name *Bogla*.

(292) BUTORIDES JAVANICA.—The Little Green Heron.

Blanford, No. 1567 ; *Hume*, No. 931.

Fairly common. They breed here in May, June and July. I have never found them breeding in colonies as stated by Mr. G. Dalgliesh in the *Zoologist*. They are not so nocturnal as supposed to be, for I have very often found them on the edge of a bare tank in broad daylight. Native name *Kát bogla*.

(293) NYCTICORAX GRISEUS.—The Night Heron.

Blanford, No. 1568 ; *Hume*, No. 937.

Rather uncommon. I have found them at different times throughout the year. In June a few were nesting in a mango grove not far from Baghownie, but they deserted the place. Native name *Wák*.

(294) ARDETTA SINENSIS.—The Yellow Bittern.

Blanford, No. 1571 ; *Hume*, No. 934.

Very rare. I have only secured a single specimen which was shot in a paddy field near Jainagar in September. Mr. G. Dalgliesh got one in Dalsing Serai in December.

(295) A. CINNAMOMEA.—The Chestnut Bittern.

Blanford, No. 1572 ; *Hume*, No. 933.

Fairly common. I have taken a few nests in August and September. Native name *Lal bogla*.

(296) DUPETOR FLAVICOLLIS.—The Black Bittern.

Blanford, No. 1573 ; *Hume*, No. 932.

Very rare. I have never seen this species in the sub-division and only secured a pair on the 24th May at Baghownie. They were on the edge of a tank in the Factory. In their stomachs were the remains of shell and other fish and water insects. Mr. G. Dalgliesh got a pair at Bunhar Factory in February.

(297) BOTAURUS STELLARIS.—The Bittern.

Blanford, No. 1574 ; *Hume*, No. 936.

I have also found this species scarce. One or two have been shot here and about half a dozen brought in by *mir-shikars*. They are cold-weather visitants. The latest date on which one was got was the 29th March. Mr. G. Dalgliesh also shot a pair of this species. Native name *Moon*.

(*To be continued.*)

THE FERNS OF NORTH-WESTERN INDIA.

Including AFGHANISTAN, the TRANS-INDUS PROTECTED STATES, and KASHMIR: arranged and named on the basis of Hooker and Baker's *Synopsis Filicum*, and other works, with New Species added.

BY C. W. HOPE.

(*Continued from page* 749, *Vol.* XIV.)

PART III.—THE GENERAL LIST—(*continued*).

Genus 26.—POLYPODIUM, *L.*

Subgenus PHEGOPTERIS, *Fée.*

1. **P. erubescens,** Wall.; Syn. Fil. 306; C. R. 543. *Phegopteris erubescens*, Wall. (under *Polypodium*), Bedd. H. B. 289.

KASHMIR: Basaoli, 5500′, Clarke 1876; MacLeod 1891: "mouth of gorge near 30th milestone, in very wet soil, 6-8000′."

PUNJAB: *Hazara Dist.*—Siran Range, coll. Inayat, Sahar. Herb. collr. 1899; *Chamba* State, McDonell, J. Marten 1898, *Kullu*—6-8000′, Coventry 1894; *Simla Reg.*—Edgeworth, Bates: near Simla 5-6000′, and Mashobra 7-8000′, Blanford: "at the bottom of some of the deep valleys below Simla, where it is pretty common. My highest elevation is about 5500′"; Sirmur, T. Thomson.

N.-W. P.: *D. D. Dist.*—Jaunsar 4500′, C. G. Rogers; Mussooree 4-6000′, by water, not uncommon; *T. Garh.*—Phedi 4-5000′, and below Laluri 3-4000′, Duthie; *B. Garh.*—Mrs. Fisher; *Kumaun*—R. B. 1827, Wallich type specimen; Ramganga R. and Karim 6200′, S. and W. 1848; Naini Tàl 55-6000′, Hope 1861; Davidson, Trotter; ridge above Bageswar 6000′, MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.), Nepál, *Wallich* Sikkim; Assam—Khasia 3-7000′, "somewhat rare." Malay Penins. and Isles. China—Yunnan, *Delavay* 1886.

Lowest pair of pinnæ deflexed. Stipes and rhachises not always pink: sometimes pale-yellow or straw-coloured. Grows in wet ground below springs, or by the sides of streams—the fronds bending over the water, and attains a large size, 10 ft. long, including the long stipes—if my memory serves me rightly as to Naini Tāl specimens. A Chamba specimen has pinnæ $13\frac{1}{2}$ in. l. by $1\frac{1}{8}$ br. It grows 8 ft. high in Mussooree.

2. **P. auriculatum,** Wall.; Syn. Fil. 306; C. R. 543. *Phegopteris auriculata*, Wall. (under *Polypodium*), Bedd. H. B. 290.

PUNJAB: *Chamba State*—McDonell; *Simla Reg.*—Edgeworth; near Koti 6000′, Gamble 1878; Sámal Vy. (below Simla) 4500′, Blanford: "very rare in the neighbourhood of Simla. I have met with it but once"; Simla—several stations, 57-6000′, Bliss 1890-91 and 92.

N.-W. P.: *D. D. Dist.*—Mussooree, King, in Herb. Hort. Sahar.; *B. Garh.* 4-5000′, Duthie 1885; *Kumaun*—Naini Tál, Hope 1861; Goriganga Vy. 6500′, MacLeod 1893, pinnæ very narrow: "grows almost in beds of streams, in dense shade."

DISTRIB.—*Asia*: N. Ind. (Him.), Nepál, *Wallich* 1821; Sikkim and Bhotán, 5-8000′: "plentiful about Darjeeling"; Assam—Khasia 5000′, Hook. fil. et T. Thomson. Java: *fide* Clarke. China—Yunnan, Mengtze 6000′, *Henry*.

A specimen collected by Mr. Bliss at Simla is 16 in. br. with pinnæ 1½ in. wide, 1¾ in. nearest rhachis, veinlets 12—14 of a side, up to 17 in lowest segments, forked in lowest, and occasionally so in next above. In this species the sori are considerably nearer the costa than the edge.

3. **P. Phegopteris**, L.; Syn. Fil. 308; C. R. 544. *Phegopteris vulgaris*, Mett., Bedd. H. B. 290.

TRANS-IND. STATES: *Dir.*—Mirga 9500′, Surg.-Lt. S. A. Harriss, 1895.

KASHMIR:—Tajwas Nála, 11-12,000′, Levinge 1872-75; Dr. Aitchison 86-10,000′; Sarpat 10,000′, MacLeod; Gulmarg 8-9000′, Duthie.

PUNJAB: *Chamba*—Pángi 8000′, McDonell 1882; Upper Chenáb Vy. 8000′ (in Kashmir?), Baden Powell 1879; "Chamba" J. Marten; *Pa'ngi*—Sánch Vy. 8500′, Harsukh (Sahar. Herb. collr.) 1899; *Lahaul*, Dr. G. Watt.

N.-W. P.: *T. Garhwal*—Banga Páni 10,000′, and Kidarkanta 10-11,000′, Duthie 1879; *Kumaun*—between Milain and Rilkot 10,000′, MacLeod 1893.

DISTRIB.—*Amer.*: Greenland to Alaska, Labrador, Newfoundland, and Canada; *U. S.*: New England to Virginia and westward; *Europe*: Iceland, Scandinavia and British Isles to Spain, N. Italy and Greece, and intervening regions; Caucasus. *Asia*: N. Ind. (Him.), Sikkim—Sundukphu 11,500′ Levinge. Siberia, Mandschuria, Kamschatka, and Japan.

4. **P. distans**, Don; Syn. Fil. 308; C. R. 544. *Phegopteris distans*, Don (under *Polypodium*), Bedd. H. B. 292.

KASHMIR: ?

PUNJAB:—*Chamba*? *Simla Region*?

N.-W. P.: *D. D. Dist.*—Jaunsar, Chakráta 7000′, Gamble No. 22,825, 1891; *Kumaun*, near suspension bridge on old road to Almora, Hope 1861.

DISTRIB.—*Asia*: N. Ind. (Him.), Nepal, *Wallich*; Sikkim, *C. B. Clarke*: typical; Assam—Khasia, *Simons*. Malay Peninsula. Java. China.

As both Clarke and Beddome say, *P. distans* has tufted stipes, and as in all Gamble's specimens from Sikkim and Chittagong—16 sheets—which are complete, the caudex is erect with tufted stipes, and as this is the character of some thirty specimens in the Calcutta Herbarium, I have separated the numerous specimens from N.-W. India, hitherto called *P. distans*, but which have a widely creeping and branching rhizome, and I give them as a new species—*P. late-repens*, next below. I am doubtful about the Kashmir specimens which I have not seen except Trotter's, which we agreed are *late-repens*, and also about McDonell's from Chamba. Gamble's, and some of Blanford's, specimens from the Simla Region have erect caudices, and so have Gamble's from Jaunsar in the Dehra Dún District. The Kumaun specimens have the caudex rather decumbent and stipes subtufted, but are otherwise the same.

Generally speaking, *P. distans* seems to be a smaller, stiffer, narrower, and less cut fern than the next, but occasionally the fronds are broad for their length. This is so with a specimen from Sikkim, coll. King, No. 4132, 1877, which Sir George kindly sent me in 1890, as a type of Don's plant. That frond is

14 inches broad. The stipes are very erect, closely set, and densely scaly for some way up. The pinnæ are cut down ¾ or 4/5ths to the rhachis, and the segments are entire, or very slightly crenate at the apex. Don's description in the Prod. Fl. Nepàl is :—

"*P. distans*, fronde lanceolatâ—pinnatâ : primus distantibus suboppositis lanceolatis acuminatis altepinnatifidis pilosiusculis ; segmentes oblongis apice rotundatis ; imis inciso-serratis ; superioribus repandis, stipite rhachique semi-territibus villosis, soris remotis biserialis.

"Hab. in Nepaliæ alpibus, Wallich. Frons bi—v. tripedalis. Rhachis purpurascens."

There is no allusion to a rhizome in the above. Mr. Duthie once kindly noted down for me the localities and collector's names of the (Indian ?) specimens named *P. distans* in the Calcutta Herbarium ; and I grouped them in five forms, thus :—(1) *Typical form*, from Simla, *Gamble* ; Sikkim, Khasia, and Nilgiris ; (2) *var. minor*, *C. B. Clarke*, from Sikkim ; (3) *var. glabrata*, *C. B. Clarke*, Kumaun, *R. Blinkworth*, without rhizome, named *P. brunneum* Wall. on original ticket : margins of segments almost entire ; (4) *var. paludosum*, from Labaul, Khasia, Nilgiris *Gamble*, and Ceylon,—rhizome erect, stipes tufted ; and (5) *var. adnata* (sp.) Wall., from Dharmsala *Edgeworth*, Chamba *C. B. Clarke*, Garhwal 8000′ *Blanford*, Nepal, Nilgiris *Beddome*, Ceylon *Thwaites*. Mr. Duthie noted that there were no type specimens of Don or Wallich, except a doubtful one of each ; and that the specimen ascribed to Don looked very different from the rest of *var. adnata*, the margins of the segments being almost entire.

5. **P. late-repens**, n. sp., (Trotter MS.) *Hope* Plate XIV. (see Vol. XII., p. 628).

Add.—for Jaunsar hab.—Molta Range 6000′, Duthie 1896 ; *B. Garh.* Mrs. Fisher : pinnules entire, only toothed at points : no stipes present. *Kumaun* : Inayat, nat. collr. Sahar. Herbarium, No. 25,088, 8-1890.

6. **P. Dryopteris**, L., including *P. Robertianum* Hoffm.; Syn. Fil. 309; C. R. 545. *Phegopteris Dryopteris*, Linn. (under *Polypodium*), Bedd. H. B. 293.

AFGHAN : Kurram Vy., Aitch. 1879 ; Peiwàs Kotal, Collett 1879.

TRANS-IND. STATES : *Baraul*—Mirga 7500′, Gatacre 1895 ; *Chitral*, J. E. Younghusband 1894.

KASHMIR ; 7-13,000′, frequent ; Gilgit—Toltion Indus, 5000′, Winterbottom 1847.

PUNJAB : Hazara Dist.—Kagán Vy., Inayat (Sahar. Herb. collr.) 1896 (probably *P. Robertianum*); *Chamba State* 7-8000′, McDonell, J. Marten, 1882 to 1899 ; *Kangra Vy. Dist.* 8900′, Harsukh (Sahar. Herb. collr.) 1899.

N.-W. P. : *T. Garhwal*—Ganges Vy., 8-11,000′ Duthie ; *B. Garh*—Dombitia Gadh 9000′, Duthie ; *Kumaun* 10-13,000′, Duthie, Trotter, MacLeod.

DISTRIB.—*Amer.* : Greenland and Sitka to Rocky Mts., Canada and Newfoundland ; *U.S.* : N. E. States to Virginia, and westward to Oregon and Alaska. *Europe* : Widely distributed, from the extreme north to Italy and south of Spain. *Asia* : Seberia and Kamschatka. China—Peking Mts. 5000′, *Hancock* : "very rare"; Mukden—Kirin, *James*.

I have marked some of the specimens enumerated above *P. Dryopteris*, and others *P. Robertianum*, but there are others I am not sure about. I think the difference between the two plants is not so great as it is in Great Britain. I agree with Mr. Clarke that if *P. Robertianum* is distinct it grows in the N.-W. Himalaya.

7. **P. ornatum**, Wall. Cat. 327 ; C. R. 545. *Phegopteris ornata*, Wall. (under *Polypodium*), Bedd. F. S. I., t. 171, H. B. 294.

N.-W. P. :—*Kumaun* : *fide* Clarke in 'Review.'

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotán, in tropical valleys 0-2000′, common ; Bengal—Chittagong Hills 500′, S. Ind.—Carcoor Ghâts, Malabar, and elsewhere along the Western Ghats, but not common—*de* Beddome. Ceylon. Malaya. N. Australia. Polynesia.

I enter this species on Mr. Clarke's authority, but I do not think it can be common in Kumaun, as he seems to say, for none of my correspondents seem to have found it there. I have not myself collected in the low-lying valleys of Kumaun, except in that of the Gola, from about 2000′ upwards, and I did not see it there.

8. **P. punctatum.** Thunb. : Syn. Fil. 312. *P. rugosulum*, Labill., C. R. 546. *Phegopteris punctata* Thunb. (under *Polypodium*), Bedd. H. B. 295.

PUNJAB : *Chamba*, McDonell, J. Marten ; *Kullu*—Trotter, in List ; *Simla Reg.* : Asan Valley, Edgeworth 1840 ; seen, freshly gathered, by Hope, 1886—said to be from Rifle Range, E. of Jako Mt. 6-7000′ : not in Blanford's List and not got by Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar, Lakhwa 3-4000′, Gammie ; Chatra 6000′, Gamble ; *T. Garh.* 4-5000′, Herschel, Mackinnons, Hope, Duthie ; *Kumaun* T. T. 1845, S. and W. 5-7000′, Duthie, Trotter, MacLeod.

DISTRIB.—*Amer.* : Columbia to Chili. *Asia* : N. Ind. (Him.), Nepal *Wallich* ; Sikkim and Bhotan; Assam—Mishmi *Griffith*, Khasia *T. Lobb.* Bengal—Chittagong, alt. 1000′—5000′. S. Ind., common on W. Mts. at high alts. Ceylon, Malay Penins. Tonkin. Java. Philippines. Japan. Sandwich Isles. N. Caledonia. Moluccas. Australia. N. Zealand. Van Dieman's Land. *Afr.* : Fernando Po 7000′. Tristan da Cunha St. Helena. Bourbon. Madagascar.

Subgenus GONIOPTERIS, *Presl.*

9. **P. urophyllum**, Wall. Cat. 299 ; Syn. Fil. 314 ; C. R. 547. *Nephrodium urophyllum*, Wall. (under *Polypodium*), Bedd. H. B. 274 and Suppt. 72.

N.-W. P. : *Garhwal* and *Kumaun*, *fide* Clarke in 'Review.'

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotan ; Assam—Khasia ; Bengal—Chittagong. Burma. Ceylon. Malaya. New Hebrides—Aneiteum. *China* : Chusan. Polynesia. N. Australia. Queensland.

I have not seen the specimens from the west of Nepal on which Clarke founds, nor any others from N.-W. India.

10. **P. proliferum**, Presl.; Syn. Fil. 315. *P. proliferum* (Roxb.) Wall. Cat. 312, C. R. 548. *Goniopteris prolifera* Roxb., Bedd. H. B. 296. *Meniscium proliferum* (*Sw.*) *Hook* 2nd Cent.

KASHMIR : 3000′; Trotter in List.

PUNJAB : *Chamba*—McDonell in List; near Dalhousie 3000′, Trotter, *Kangra Valley Dist.* 2-3000′, Trotter.

N.-W. P.: *D. D. Dist.*—Very common in the Dún, on banks of streams and canals, up to perhaps 3000′; *T. Garh.* 1500′, *Hope*, 3000′ Mackinnons; *Saharanpur Dist.*—Roorkee, Lt. Sedgwick, R.E.; *Kumaun*—The Bhabar 1000′, S. and W.; Gonai, Davidson, above Katgodam—below 2000′, Hope; *Gorakhpur Dist.*—Sirna Tal, on banks of Rohni R: had been submerged 11ft. by a flood, A. Campbell; Moradabad, T. T. 1844; North Oudh Forests, R. Thompson.

DISTRIB.—*Asia*: N. Ind.—eastward in the plains, and westward along the foot of the hills up to 3000′; Chutia Nagpur, *Rev. A. Campbell*; Central Provs., Hoshangabad Dist., *Duthie*; The Concan, *Law.* S. Ind.; Ceylon—Trincomalee, *Wight*; Burma—Mergui. Malaya S. China. Philippines. N. Caledonia. N. Australia. S. Australia—Queensland. New Guinea. *Afr*: Angola. Zambesi Land. Shire—near Blantyre; E. Trop. Africa. Mauritius. S. Africa.

As I find none of the published descriptions of this species sufficient, I venture the following, which is founded on long observation of growing plants:—

> *Rhizome* stout, slowly creeping and branching. *Fronds* springing sometimes in tufts, procumbent, or climbing among bushes and in hedgerows: sometimes of definite length, broad, spreading, and sterile, but one or more fronds of a tuft having a leading prolonged rhachis which throws off branches from buds at the axils of the pinnae 3-6 inches apart, up to 6 branches per bud, and, if trailing on the ground, becomes an epigeous rhizome, throwing out roots as well as branches from the axils, but ultimately diminishes in width and becomes flagelliform: the side branches fertile, and often prolonged, sending out one or more branches from each bud as does the main rhachis: the main flagelliform rhachis often fertile to the apex. (*Quoad ultra— vide auctores*).

Some of my observations were made on plants naturalised in my garden in Dehra (N.-W. P.), transplants from a closely adjoining natural station. Given moisture and other favourable circumstances, this species is capable of great development: I believe lateral shoots sometimes become leaders. Beddome is certainly wrong in saying that the elongated and flagelliform fronds are "non-seeding," as specimens in my collection show.

11. **P. lineatum**, Colebr. in Wall. Cat. 300 ; Syn. Fil. 316 ; C. R. 548. *Nephrodium costatum*, Wall. (under *Polypodium*), Bedd. H. B. 275 and Suppt. 73.

Kashmir : Tawi Vy. 4000′, Levinge 1875 ; Trotter, in MS. List ; Jhelam Vy. "35th Milestone," MacLeod 1891.

Punjab : *Chamba State*—McDonell in List ; Chamba 5000′, Blanford, Trotter ; *Simla Reg.*—Simla 5500′, Bates, Gamble, Bliss ; Sirmur—T. T.

N.-W. P. : "N. W. I.", very red, Falconer ; *D. D. Dist.*—Mussooree 4-6000′ by streams and in swampy ground, not uncommon, Herb. Dalzel, King, Mackinnons, Duthie, Hope ; *T. Garh*—Mackinnons, Duthie 4-5000′ ; *B. Garh.*—Mrs. Fisher ; *Kumaun*—Wallich ; Phurka and Bagesar 3500′, S. and W. 1848 ; Col. Davidson 1875 (very red) ; Nalena Vy. 47-5000′, Hope 1890 (only slightly red) ; near Bagesar 3000′, Trotter 1891.

Distrib.—*Asia* : N. Ind. (Him.) Nepál, *Wallich* 1827 ; Assam—Mishi, *Griffith*, Khasia. Silhet. Ceylon. Penang. China-Centr., *Mr. Maries* ; Ichang, *Henry* ; *Szechwan* : Mt. Omei, *Faber* ; *Yunnan* : Mengtze, *Hancock*.

A very different looking plant from the next, and much more elegant. The rhizome is widely creeping, never erect. By the side of running water it grows to a large size. I have a frond I gathered in Kumaun, mounted on five 18½″ sheets, with stipes almost 30 in. and frond 57 in. l., and I got others larger. Mr. J. W. Furrell has seen fronds, 8 ft. long, without stipe. As is often the case with ferns having a creeping rhizome, many fronds are sterile, but otherwise the same as the fertile fronds. I have never seen any trace of involucre on even very young fronds gathered in N.-W. India. Beddome says specimens from Dr. Stuart, Garhwàl, have the involucre very distinct. Clarke, who kept the species in *Polypodium* (*Goniopteris*), says the young sori have many hairs among them.

The stipes, rhachises and veins are often quite red. The number of veins runs up to 10 pairs, the excurrent venule being often free. Beddome, in his supplement, says the rhizome is sometimes creeping, sometimes erect. I find it is always widely creeping. Beddome may have mixed up two distinct ferns ; and I cannot admit that a fern can be so inconsistent in its structure and habit as he says this is.

12. **P. multilineatum**, Wall. ; Syn. Fil. 316 ; C. R. 547. *Nephrodium moulmeinense*, Bedd. H. B. 275, F. B. I., t. 231.

Kashmir : Poonch 3000′, Major Sage : *fide* Trotter in printed List.

N. W. P. : *D. D. Dist.*—in the Dún, Nalota Khála about 2500′, Hope 1880-87-89 ; Ramgarh Road 2000′, Gamble 1892 ; below Mussooree, to westward, 4000′, Mackinnons 1878 ; Biráni Nadi, Duthie 1882 ; B. Garhwál, Mrs. Fisher ; *Kumaun*, Almora, Davidson 1875 ; Kali Vy. 2-3000′, Duthie 1884 ; Gola Vy. 2500′, Hope 1890 ; Sarju Vy., near Bagesar, 3000′ S. and W. ; 3-3500′, Trotter 1891. *North Oudh* Forests, R. Thompson.

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotàn ; *Bengal* : Chittagong and plain westward, and ascending the Himalaya to 4-5000′, Parasnáth Mt. *Rev. A. Campbell* ; Assam—*Wallich* 1829 ; all over the Province ; Nambur Forest, *Mann. S. Ind.* : Golconda Hills, west of Vizagapatam, 2-3000′, " involucre distinct " ; not on Western Mts., *Beddome* in H. B. *Burma* : " very common near Moulmein, involucre distinct ", *Beddome*. Fiji Isles, Seeman ?

Under *P. lineatum*, Baker remarks—" Seems not distinct from the next, "—but see my remark above as to the contrast between the two. The present plant is more coriaceous, and very dry-looking, with veins very prominent and distinct ; the fronds are generally broader and shorter, and have fewer pinnæ than *P. lineatum* has,—4-15 pairs in Gamble's and my specimens ; whereas in our *P. lineatum* the number varies from 8 to 30 pairs, only 3 specimens having less than 16 pairs. A specimen I have, from Parasnàth Mt. in Bengal, is 7′-6½″ high from the rhizome, of which total the stipe is 44½ inches, and the frond 46. It has only 14 pairs of pinnæ : the lowest are 10 in. l., the next pair 12″, and above that there are several about 13 in. The width of the broadest is barely above 1½ in. The pinnæ of *P. multilineatum* are much the broader, and the number of pairs of veins runs up to 23 and even 25. Trotter's plant from Kumaun has the narrowest pinnæ of any I have seen—⅞ in., but it nevertheless has 16 pairs of veins. My Kumaun specimens were growing in a swampy slope in forest : very few fronds were fertile. As Beddome added in his supplement, the rhizome is creeping : the stipes are distinct.

Blanford, in his published List, gives Simla as a habitat, saying :—" ' The Glen' and some other wooded ravines below 6000′. The pinnæ are narrow." I think this must be *P. lineatum* Colebr. His specimen of *P. lineatum* from Chamba is marked by him *P. multilineatum*, and yet has the narrowest pinnæ of any *lineatum*, I have seen, with only 6-7 pairs of veins. Trotter says he collected *P. multilineatum* in Chamba and Simla ; and if he is right as to Major Sage's specimen from Kashmir this is probable enough ; but the evidence I have seems insufficient.

I have never seen the slightest trace of involucre in this fern, as growing in N.-W. India ; but I detected some in Gamble's specimens from the Palkonda Hills in the Vizagapatam District, 2500′, and the Rumpa Hills, 2000′, in the Godavery District, Madras Presidency. The Rumpa Hills plant has pinnæ cut down about ⅓ of the half width (½ in terminal pinnæ), segments wider than in other *P. multilineatum*, and not more than 13 pairs of veins, which curve upwards ; and the sori are at a distance from the costa instead of near it ; they are much nearer the excurrent veinlet. These Madras specimens may be the same as the Moulmein plant, which I have not seen ; and I suspect Beddome may be right in setting up *N. moulmeinense*, but wrong in upsetting *P. multilineatum*. In his supplement of 1892 he says that fronds of *N. moul-*

meinense lately received in a very young state show ciliated involucres on almost all the sori; and that Mr. Mann's specimens from the Nambur Forest, Assam, have the pinnæ 2¼ inches broad. 1⅝ in. is, I think, the broadest I have of *P. multilineatum.*

Subgenus EUPOLYPODIUM.

13. **P. subfalcatum**, Bl.; Syn. Fil. 328; C. R. 449, Bedd. H.B. 314.

N.-W. P.—*B. Garh.*, Mackinnons 1882; *Kumaun*—Kalimundi 8500′, S. and W., No. 19; *P.* part of Wall. 310; named *P. subfalcatum* by Sir W. J. Hooker. Above Gini 6-7000′, near Sosa 9-10,000′, Duthie 1884. North India, Edgeworth, *fide* Hooker.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*, Central Nepál, *J. Scully* 1880. Sikkim and Bhotán, common; Assam—Khasia 4-5000′, frequent. S. Ind.—Nilgiris and Anamallays 4-5000′. Ceylon—Centr. Prov. Malay Penins. 3-4000′, and Isles. Philippines, *Cuming*; Borneo; Moluccas—Batjan Isd.; New Guinea, *Beccariect.*

Subgenus GONIOPHLEBIUM, Bl.

14. **P. amœnum**, Wall.; Syn. Fil. 341; C. R. 550. *Goniophlebium amœnum*, Wall. (under *Polypodium*), Bedd. H. B. 317.

PUNJAB: *Chamba*, McDonell; 5-8000′, J. Marten 1897; *Kangra Vy. Dist.* 8000′; *Kullu* 6-8000′, Trotter, Coventry; *Simla Reg.*—Simla and neighbourhood, and eastward along Thibet Road to Bisahir, 6-9500′, T. T., Edgeworth, Bates, Hope, Gamble, Blanf, Trotter, Bliss, Lace; Sirmur, T. T.

N.-W. P.: *D. D. Dist.*—Jaunsar, Dakera 5500′, C. G. Rogers, Harianta 8500′, Gamble 1898; Mussooree—'The Park' Hope; Landour—Seal's Hill 7000′, Hope; *T. Garh.* Nág Tiba Mt. 9000′, Mackinnons; Ganges Vy. 7-8000′, Duthie, Datuni 7000′, Gamble; "Garhwál," Griffith 1845; *B. Garh.*, Mrs. Fisher; *Kumaun*—Kathi 7500′, Jagesar 6000′, S. & W., near Naini Tál 5500′ Hope; above Ramgarh 7000′, Trotter; Kála Muni Ridge 9500′, MacLeod.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim and Bhotán; Assam—Khasia Dist. 3-6000′, very common; Manipur *G. Watt.* China, *Henry*, *Hancock*; Formosa (doubted by Clarke). Tonkin, *Balansa.*

Mr. Clarke can distinguish this fern from some large specimens of *P. lachnopus* Wall. (No. 15 below) only by the scales (on rhizome ?) not being hair-pointed: he says there is no difference between the two, and he has *P. lachnopus* exceedingly large. One does not need to look at the scales to distinguish between the two species. *P. amœnum* has a broadly lanceolate frond—twice to thrice, rarely more—as long as it is broad: *P. lachnopus* is linear-lanceolate, commonly six to seven times as long as broad, and rarely is the breadth so much as one-fifth of the length: 15in. l. by 2in. broad are common dimensions, and I have a frond 21 in. by 3 in. The number of pinnæ (or lobes) in the two species is considerably different: in *amœnum* it is sometimes less than 20, generally 25-30, and very rarely reaching 25-40; in *lachnopus* the number is rarely below 30, and frequently reaches 45 or more. In *amœnum* the costæ of the segments are from ⅝ in. to 1¼ in. apart, and the segments gradually taper from a broad base to a generally very fine point: in *lachnopus* the costæ are generally about 3/8 to 7/16 in. apart, rarely ½ in. or over, and the segments suddenly taper at about two-thirds of their length. The fronds of *lachnopus* are much weaker and thinner than those of *amœnum*, and they hang perpendicularly from the trees they grow on. I have rarely seen *P. lachnopus* on rocks. *P. amœnum* generally, I think, grows on rocks, or in soil on rocky slopes, sometimes standing upright; but in Mussooree I have seen it on trees. When in a young state the fronds are very pubescent, and always there are numerous small chaffy scales on and near the rhachis on the under side. The fronds of *P. lachnopus* are all but naked.

15. **P. lachnopus**, Wall.; Syn. Fil. 342; C. R. 551. *Goniophlebium lachnopus*, Wall., Bedd. H. B. 319.

KASHMIR : *fide* Clarke, in 'Review.'

PUNJAB : *Kullu* 5-7000′, Trotter in printed List; *Simla Region*—Simla, Edgeworth 5-5500′, Gamble, Blanford, Trotter, "not very common"; Mashobra, Bliss.

N.-W. P. : *D. D. Dist.*—in the Dún : Nalota Khála 2600′, Hope; Mussooree 55-6500′, in many places, on trees, Duthie, Mackinnons, Hope; *T. Garh.*—Jumna Vy. 6-7000′, Duthie, Sahlra Vy. 6000′, Gamble; *Kumaun*—R. Bl.; Mohargiri 6500′, S. and W. 1848; Hawalbágh; Naini Tál, S. and W., Hope, Davidson; near Askot 4-5000′, Duthie; Nalena Vy. 47-5000′, on rocks, Hope; Sarju Vy., Bansi 5500′ Trotter; Goriganga Vy. 8500′, Kála Muni Ridge 8500′, MacLeod.

DISTRIB.—*Asia* : N. E. Ind. (Him.) Nepál; *Wallich* 1821; Sikkim and Bhotán; Assam—Khasia Dist. 3-5000′, "very common," *Clarke*; N. Manipur 5500′, *Clarke*.

See my remarks under *P. amœnum*, Wall., No. 14, above. Occasionally, when growing in an exposed dry situation I suppose, this fern is very small and wiry : Duthie's example from the Jumna Valley has fronds only 4″×1¼″ l. including stipes. MacLeod's, from the Kála Muni Ridge, Kumaun, is from 6 to 11 in. including stipes. I watched this fern at Mussooree for a number of years, and I believed it was spreading there. It is a striking object, hanging from the large oak trees in the forest, on the north side of the ridge, up to 6500′ alt., and I could easily distinguish it from *P. microrhizoma*, Clarke (which is much more common) at some distance. The elevation—"up to 11,000′"—given in the *Synopsis*, seems much too high, and Clarke's higher limit, 6000′, is too low; but Beddome has cut that down to 3000′, on what authority I know not. Blanford says—"Not very common at Simla. Found on trees and rocks in shady ravines below 6000′."

16. **P. microrrhizoma**, C. B. Clarke, in Trans. Linn. *Soc.*, 2d. Ser. Bot., Vol. I, 1880, p. 551 (C. R.); Syn. Fil., 2d. Ed., 511. *Goniophlebium microrrhizoma*, Clarke, Bedd. H. B. 322.

KASHMIR.—*fide* Clarke; Trotter in Lists.

PUNJAB : *Chamba*—McDonell in List; J. Marten 5-7000′, 1897; *Mandi State* 5000′, Trotter; *Kangra Vy. Dist.* Dalhousie, Clarke; *Kullu* 7-9000′, Trotter; *Simla Reg.*—Simla, and eastward along ridge to Matiána 6-9000′: "very common on rocks and trees from 5500′ to 8500′" (Blanford in List).

N.-W. P.: *D. D. Dist.*—Mussooree and Landour 6-7500′, everywhere, on rocks and trees; *B. Garh.*, Mrs. Fisher; *Kumaun*—Jagesar 6000′, S. and W.; Naini Tál; Kali Vy. 9-10,000′, Duthie; Goriganga Valley 7000′, MacLeod.

Distrib.—*Asia*: N. Ind. (Him.) Sikkim and Bhotan; Assam—Jakpho Mt. 9000′, *Clarke*: China—Yunnan, *Delavay*, *Henry*.

Besides the difference in the scales of rhizome between this species and *P. lachnopus*, distinguishing characters of *microrrhizoma* not mentioned by Mr. Clarke are—the brown stipes, and darker brown rhachis; the broader, shorter, and rather stouter frond; pinnæ much fewer—generally only 15-25 pairs—and broader; and sori often oblong or oval. At Mussooree this fern grows to a higher level than *P. lachnopus*. The rhizome does not strike me as being very small.

17. **P. argutum**, Wall.; Syn. Fil. 511; C. R. 551. *Goniophlebium argutum*, Wall. (under *Polypodium*), Bedd. H. B. 323.

N.-W. P.: *D. D. Dist.*—Mussooree 6500′, Hope 1885; *T. Garh.*—Nág Tiba Mt. 8000′ Mackinnons 8000′; *B. Garh.* 6-7000′, Duthie 1885, Mrs. Fisher; *Kumaun*, R. Bl.; Binsar, on trees, 7000′, S. and W. 1848, and Major Madden; Naini Tál 5-8000′, on trees, Hope 1861, Davidson 1875; between Gini and Munshiari 7-8000′, above Gini 6-7000′, and Gori Vy. 7-8000′, Duthie 1884; above Lonarkhet 7500′, Trotter 1891; Ránti and Kála Muni Ridge 7-10,000′, MacLeod 1893.

Distrib.—*Asia*: N. Ind. (Him.) Nepál, *Wallich* 1829; Sikkim and Bhotán, 4-9000′, very common; Assam—Khasia.

Mr. Clarke gives—"Himalaya, from Kashmir to Bhotán, very common" as habitats for this species, but I cannot find any specimens from the westward of Tehri Garhwal in the N.-W. Provinces, nor did Mr. Trotter; and Mr. Blanford is silent as to the Simla Region. The Jaunsar Tract of the Dehra Dún District also seems a blank.

My plant from Mussooree is from the only known station in, or within, two days' journey of that place: it must be 10 or 15 miles from Nág Tiba Mt. in a straight line across the deep valley of the Aglar River. I found the fern in Mussooree on one branch of one Rhododendron (*arboreum*) tree only, and left most of the rhizome and fronds on it, and it was still there in 1895, but did not appear to have spread to other trees. *P. argutum* was pretty common in Naini Tál in 1861, on the Sher-ka-danda side of the Lake, high up.

Subgenus Niphobolus, *Auct.*

19. **P. adnascens**, Sw.; Syn. Fil. 349; C. R. 552. *Niphobolus adnascens*, Sw. (under *Polypodium*), Bedd. H. B. 324.

N.-W. P.: *B. Garh.* 3-4000′, P. W. Mackinnon 1881; *Kumaun*—Ramganga R. 2500. S. and W.; 4-5000′ and 3-4000′, Duthie 1884; Sarju Vy. 3500′, Trotter 1891; "Goriganga Valley and elsewhere," 5-8000′, MacLeod 1893.

Distrib.—*Asia*: "Throughout N. India in moist climates," *Clarke*. Himalaya—up to 5000′ and even 8000′: "extending over the plains to Calcutta and the sea-face of the Soonderbun"; Assam—Kachar, Mishmi *Griffith*, Manipur, *Watt*. S. Ind. Burma—

Mergui, *Griffith*, Andaman Islands. Ceylon. Malaya. Tonkin. China—Yunnan. Chusan. Fiji. New Hebrides,—Aneiteum N. Australia—Cape York. *Afr.*: Camerun Mts. Eritrea, G. Schweinfurth, 1896 ? Mascaren Isles.

New to N.-W. India ; and there not found westward of the Ganges.

20. **P. stigmosum,** Sw.; Syn. Fil. 350 ; C. R. 553. *Niphobolus stigmosus* Sw., Bedd. H. B. 328.

N.-W. P.: *T. Garhwal*—4000′, Mackinnons 1878 ; below Laluri 3-4000′, Duthie 1881 ; *Kumaun*—Sarju Vy.—Gangoli Hát 3000′, Major Madden ; Káli Vy. 2-3000′, Duthie 1884 ; Gola Valley 2300′, Hope 1890 ; Sarju Vy.—Bageswar, T. T., 3000′ S. and W., Trotter 1891 ; Sarju and Goriganga Valleys 3-5000′, MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim and Bhotán 1-4-5000′, Assam—Khasia 2-3000′ very common ; W. Manipur 3500′, *Clarke* ; Bengal—Chutia Nagpur, Parasnáth Mt. 2500′, *Clarke.* S. Ind.—Golconda Mts. Burma—Tenasserim. Sumatra, *Hancock.* China—Yunnan, *Henry*, *Hancock.*

21. **P. fissum,** Baker; Syn. Fil. 351 ; C. R. 554. *Niphobolus fissus,* Bl., Bedd. H. B. 330.

KASHMIR : *fide* Clarke in 'Review', and Trotter in Lists.

PUNJAB : *Chamba*—Ravi Vy. 6000′, McDonell ; 5500′, J. Marten 1897 ; *Kullu*—Upper Biás Vy. 5-6000′, Trotter ; *Simla Reg.*, Blanford : "rare, and found only at levels below 5500′" ; below Simla 5500′, Hope ; Simla—"The Glen" and road to it, Jaru-ka—Nál, Bliss 1890-92.

N.-W. P. : *D. D. Dist.*—Jaunsar, Duthie 1879, Lokár, Gamble ; "Jaunsar," C. G. Rogers ; Molta Forest, 5000′, Gamble ; *T. Garh*, 5-8000′, Gamble, Mackinnons ; *B. Garh*, Mrs. Fisher ; *Kumaun*—near Bagesar 3000′, Vy. of Sarju 3500′, native collector, in Herb. Hort. Saharanpur ; Gola Vy. 23-4000′, very abundant, on rocks and trees, Hope ; Naini Tál and elsewhere 5-6500′, Hope, Duthie ; near Almora 5000′ MacLeod.

DISTRIB.—*Asia* : N. Ind. (Him.) eastward to Bhotan, very common ; Assam—Khasia 1000′-5000′, very common ; Manipur, *Watt.* S. Ind.—W. Mts. 3-8000′. Burma—The Shán Hills, *Collett* ; Ceylon—C. Prov. Malay Penins. Java. Philippines. China. *Afr.* : E. Trop. Zambesi Highlands. Madagascar.

22. **P. flocculosum,** Don ; Syn. Fil. 351 ; C. R. 554. *Niphobolus flocculosus*, Don, Bedd. H. B. 331.

PUNJAB : *Kangra Vy. Dist.*—Dharmsala 6000′, Trotter 1887 ; Simla—Edgew., and Madden, *fide* Sir J. W. Hook.

N.-W. P. : *D. D. Dist.*—from 2000′ to 5000′ : common from south of Dehra, in Dehra, northward to Rajpur, and to above Jhari Páni on road to Mussooree, on trees ; *Kumaun*—3000′-6000′, very common.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim and Bhotán, rare ; Assam—Khasia, up to 4000′, and Sylhet Plain.

The description of the shape of the frond in the '*Synopsis*'—"narrowed very gradually to both ends"—is wrong, and subsequent writers have not put it right. Clarke says—"Suddenly or gradually narrowed at base," and Beddome—"lanceolate, finely acuminate, sub-sinuate, moderately attenuated and decurrent, or broad and unequally hastate at the base." The frond is never gradually narrowed to both ends—so far as I can see. It is gradually narrowed to the apex, but always more or less suddenly to the base. Only occasionally it seems to be narrowed to the base equally on both sides; but that sometimes is because one side has been folded up in pressing, or when the shoulders are narrower than usual. I should describe the frond as—lanceolate acuminate, one half ending at the base before the other, both halves decurrent on the stipes. It is as if two longitudinal halves of lance heads, of unequal length, were joined together so that the points coincided. The shorter side is sometimes more suddenly narrowed than the other. In the same plant some of the fronds will have the shorter half of the lance head on one side, and others on the other—according as, I think, they have sprung from one or other side of the rhizome. Specimens with fronds narrowed at both ends are probably *P. fissum*, which have got mixed. The latter-mentioned species has sometimes rather broad fronds, and it too sometimes narrows below rather unequally; but it has hardly any stipes, whereas *P. flocculosum* has a stipe of one-third or more the length of the frond.

P. flocculosum is very common in Dehra, and along the road and canal avenues up to Rajpur at the foot of the Himalaya, alt. 2100-3000′, chiefly on Mango trees, which have rough bark; but since I first observed it in 1879-80 it seems to have spread also to Toon trees (*Cedrela toona*), the bark of which is much smoother. Above Rajpur, up to about 5000′, it grows in the forest on various kinds of trees, *Bauhinia* and others. It is also very abundant in the forest in the Gola Valley, below Naini Tál, up to 5000′ or higher, on rocks as well as on trees. This plant does not shed its fronds annually: they are persistent for a time, shrivelling up at the close of the rains, or during a prolonged break in them, and uncurling and appearing quite fresh after a good fall of rain in the dry season, or at the setting in of the next season's rains—quite hygroscopic in fact. This may be a character of all the species of *Niphobolus*, as it is of certain species of some other genera and subgenera—see *Asplenium exiguum* above, and *Polypodium* (*Phym.*) *lineare* below. Plants of *P. flocculosum* may be taken from a tree in the cold, or dry hot, season, soaked in water till they uncurl, and be then made good specimens of, though of course without young fronds. Mr. Trotter took some plants from Dehra to Rawalpindi, and so treated them, and laid them into his herbarium. The rhizome is slow growing and never found of any considerable length, and it throws up only a few fronds each year, in a tuft. The fronds probably live on until the rhizome dies off at the back end.

Subgenus DRYNARIA, *Bory.*

23. **P. propinquum**, Wall., Syn. Fil. 367; C. R. 556. *Drynaria propinqua*, Wall., Bedd. H. B. 339.

N.-W. P.: *T. Garh.*—in Herb. Hort. Saharanpur : marked "Kidarkanta, 5", on ticket : no collector's name. *B. Garh*—6000′, Mackinnons 1881 ; Kinoli Vy., Duthie 1885 ; Mrs. Fisher ; *Kumaun*—Ramari 4500′, Binsar 7000′, S. & W. ; Alaknanda Valley, near Joshimáth, Edgew. ; Mymunda, Davidson 1875 ; Gori Vy. 5-6000′, Duthie 1884 ; Nalena Vy. 47-5000′, Hope 1880; near Pitoragarh 6500′, Trotter 1891 ; Sarjuganga Vy. and elsewhere 4-7000′, MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.) Nepál, *Wallich* ; Sikkim and Bhotán, "very common," *Clarke* ; Assam—Khasia Dist. 2-5000′,'very common, Kohima 6000′, *Clarke*. Burma. Malay Penins. Java. China—Scechwán, on Mt. Omei, *Faber* ; Yunnan, *Delavay*, *Hancock*, *Henry*. *Afr.* : W. Islands.

24. **P. rivale**, Mett. MSS. ; Syn. Fil. 367 ; C. R. 556. *Drynaria mollis*, Bedd. H. B. 341.

PUNJAB : *Chamba*, MacDonell ; *Kullu* 8-900′, Trotter ; *Simla Reg.*—Simla and eastward to Hattu Mt. 7-9500′, on oak trees : locally abundant.

N.-W. P. : *D. D. Dist.*—Jaunsar, Deoban 9000′, Herschel and Duthie's collr. 1879; Landour 7100′, Hope ; Garhwal 8-9000′ ; Lev., *T. Garh.*—Nag Tiba Mt. 9000 Mackinnons ; Jumna and Ganges Valleys 8-10,000′ and 5-6000′, Duthie ; *B. Garh.*, Mrs. Fisher , *Kumaun*—Binsar 7000′, S. & W. ; Naini Tál and near it, Hope, Trotter ; Goriganga Vy. 8700′, MacLeod 1893 : "Grows in enormous tufts, built up of old stems."

DISTRIB.—*Asia* ; Thibet—Soulié, *Hobson*. N. Ind. (Him.) Chumbi Vy., in Thibet, on south slope of Himalaya, King's collector, 1882. China—N. Shen-Si Prov. *Revd. J. Giraldi* (P. Baronii, n. sp., *Christ*).

The '*Synopsis*' gives N.-E. Himalaya as the habitat ; but this seems a misprint for N.-W. Him., as the Chumbi Station—between Sikkim and Bhotán—was not then known. Also, in the "*Synopsis*" it is said that the venation is like that of *Goniophlebium* ; but Mr. Clarke says it is that of other *Drynarias*. Colonel Beddome gives an exact description of the fern.

Subgenus PHYMATODES, *Presl.*

25. **P. lineare**, Thumb ; Syn. Fil. 354 ; C. R. 558. *Pleopeltis linearis*, Thunb. ; Bedd. H. B. 346.

KASHMIR :—*fide* Clarke in 'Review.'

PUNJAB : Hazára Dist.—Kagán Vy. 14,400′, Inayat (collector for Herb. Sahar.) 1896 ; *Chamba*, McDonell ; Mandi State and Kullu, Trotter in List ; *Simla Reg.*—5-8000′, common.

N.-W. P. : *D. D. Dist.*—In the Dún 2-3000′, common ; Mussooree 55-6500′., in many places ; *T. Garh.*—Phedi 4-5000′ Duthie ; *B. Garh.* Mrs. Fisher ; *Kumaun*—2-9000′, common.

DISTRIB.—*Asia* : N. Ind. (Him.) Nepal, *Winterbottom* ; Sikkim and Bhotán ; Assam—Khasia Dist. 500′-6000′, "very common," W. Manipur 3000′, *Clarke*. S. Ind. —throughout, *Beddome*. Ceylon. Malayan Penins., and Isles. China. Japan. *Afr.* : S. & Centr., with the Islands.

Blanford says :—" This is a fern of comparatively the lower levels. . . . . . . The fronds are thick and coriaceous, and in dry weather roll up from the margins, and so remain for weeks and months, unrolling again, like

Niphobolus, on the return of wet weather." I confirm this. The fronds also sometimes coil up at the apex.

26. **P. simplex**, Sw., Syn. Fil. 27. *P. lineare*, Thb. β. *P. simplex*, Sw., Hk. and Bk. Syn. Fil. 354.

P. simplex, Sw., Clarke, Journ. Linn. Soc., XXV. 99. *Pleopeltis simplex*, Sw., Bedd. H. B. 347. *Polypodium* (*Phymatodes*) *simplex*, Sw., Blanford, in Journ. Asiatic Soc., Bengal, Vol. LVII., Pt. II., No. 4, 1888, Pl. xx.

PUNJAB : *Chamba*—McDonell, in List. Pangi—Satrundi, Harsukh (collr. from Sahar. Herb.) 1899 ; *Kangra Vy. Dist.*—Edgew. in Herb. Sahar. ; Dharmsála, Trotter ; Kullu 6-7000′, Trotter ; *Mandi State* 6500′, Trotter ; *Simla Region*—Simla 6-8000′, common.

N.-W. P. : *D. D. Dist.*—Jaunsar—Chakráta 7000′ ; in the Dún—Kalanga Hill 33000′, Gamble ; Mussooree and Landour, very common 6-7500′ ; *T. Garh.*—Jumna Vy. 10-11,000′, Ganges Vy. 10-12,000′ Duthie ; *B. Garh.* 8000′, Duthie, Mrs. Fisher ; *Kumaun* 6500′ to 9000′, S. & W., Hope, Duthie, Davidson, Trotter, MacLeod.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim and Bhotán. China ?

This is a very common fern in the Himalaya, on trees, and it never ought to have been mixed up with *P. lineare*, for, besides other differences, and entire dissimilarity in appearance when growing, the fronds are herbaceous in texture, and wither and fall off directly the rains cease, or before that when a touch of cold, dry wind comes from the north. The fronds of *P. lineare* are persistent for another year at least. Blanford noted this, and said—"Their texture is thin, the venation distinct." The sori when young are completely covered and protected by peltate scales, up to 20 in number to a sorus, which fit together so closely that to the naked eye they sometimes look like one large involucre with a continuous margin outside the sorus. These scales disappear as the sporangia ripen and burst. The sori are occasionally oval or confluent.

This species is still mixed up with *P. lineare* in the Kew Herbarium. Specimens from the eastward of British India seem to vary a good deal, and there may be among them a new species.

27. **P. clathratum**, C. B. Clarke in Review 559, t. 72, fig. 1 ; Baker in Ann. Bot., Vol. V., No. XVIII. *Pleopeltis clathrata*, Clarke, Bedd. H. B. 348. *Polypodium* (*Phymatodes*) *clathratum*, C. B. Clarke, Blanford, in Journ. Asiatic Soc., Bengal, Vol. LVII., Pt. II., No. 4, 1888, Pl. XXI.

AFGHAN. : Kurram Vy.—10-11,000′ Aitch. 1879-80 ; Peiwar Kotal 7000. Collett 1879.

KASHMIR : *Pir Punjál* 11-12,000′, C. B. Clarke ; *Gilgit Dist.*—Nittar Vy. 10-11,000′, Duthie. Kajnag Range and Kamri Vy. 9-13,000′ Duthie 1892 ; Ridge between Kishenganga Vys., 9-12,000′, MacLeod 1891 ; Sind Vy.—Sonamarg 8000′, Gammie 1891.

PUNJAB : Hazára Dist.—Kagán Valley, Inayat (collr. Herb. Sahar.) 1897 ; *Chamba*—Ravi Vy. 7000′, MacDonell, Pángi 12,500′, J. Marten ; Mandi State 7-9000′

Trotter; *Kullu* 8-9000′, Trotter; *Simla Reg.*—Simla 7000′, Hope 1871; Simla—"abundant on trees on north side of Jako Mt. 7000′ and a little above that level, and ranges (eastward) up to at least 10,000′ on Kamalhori and Hattu," Blanford (in List); Hope, Trotter, Bliss.

N.-W. P.: *D. D. Dist.*—Jaunsar, Mrs. Stansfield; *T. Garhwal* 8-12,000′, Duthie; *B. Garh.* 12-13,000′ Duthie, Mrs. Fisher; *Kumaun* 9-14,000′ Duthie; Lessar Pass 14,000′, MacLeod 1893.

NEPAL W.: Kali Vy., near Kangua 11,000′, Nampa Gádh 12-13,000′, Duthie.

DISTRIB.—*Asia*: N. Ind. (Him.), N. China, *Hancock.*

Mr. Clarke's description seems to have been written from material gathered in a limited tract, and his drawing is by no means an adequate representation of the plant, which seems to have various forms. The figure shows fronds not more than 6 in. l., including the stipes; and Mr. Clarke says the fronds are small. Blanford's figure is better, as it is of a larger plant, and shows the venation more correctly; but it does not give the "sessile irregularly peltate and lacerate clathrate scales" which are mixed with the sporangia and are the characteristic feature of the plant. He gives a drawing of a scale from the rhizome, and says the fern is readily distinguished from *P. simplex* by its narrow linear fronds, the character of the venation, and the clathrate scales of the rhizome and sori, as if these were identical. Clarke's enlargement of a scale from the sorus is quite different from Blanford's from the rhizome, and is correct: both are clathrate, though their shapes differ. But, as Blanford says, the scales of the sori are not persistent, and it is not easy in dried specimens to find a specimen of them. On some fronds I find similar scales on the under surface quite unconnected with sori.

P. clathratum, if all the specimens so named be that species, varies very much in dimensions and shape of frond. Duthie's high-level examples, from Garhwal, Kumaun, and West Nepal, are generally smaller than even Clarke's figure shows, and are rather coriaceous with venation obscure, but they have the characteristic scales in the sori. Duthie's No. 5178 from the Kuari Pass, British Garhwál, 13,000′, has a comparatively broad frond and short stipes, like that of *P. simplex*: stipes $1\frac{1}{4}$—$1\frac{1}{2}$ in., frond $4\frac{1}{2}$—$8\frac{1}{2}$ in. l., narrowed gradually to both ends, but it has the characteristic sorus scales in abundance. Some of my specimens from the Simla Region, gathered late in the season when withering, and with no scales in the sori, have stipes 2 in. l., and fronds 10—12 in. l. by $\frac{3}{8}$—$\frac{5}{8}$ in. br. Some of the sori in these are linear—$\frac{3}{8}$ in. l. A frond from the Mandi State, collected by Trotter, has stipes under 2 in. l., with frond 12 in. by $\frac{5}{8}$ in. A plant of Blanford's, from Kamalhori Mt., 9500′, is only 4 in. high, rather coriaceous, with venation obscure, scales wanting, sori oval or oblong. I collected plants of this form at Simla in 1871, and was then certain they were not *P. lineare.* Fronds from Chamba are 13 in. l. by $\frac{3}{8}$ to barely $\frac{5}{8}$ in. broad, very membranous, stipes very short. I have never seen stipes as long as the fronds such as Clarke speaks of; but some of Duthie's from Kashmir are $\frac{3}{7}$ths of the total length, and some of these have fronds $\frac{3}{4}$ in. br., and look like narrow *P. simplex.* If the nature of the scales is the main specific character, all these various forms are one species.

Blanford made a particular study of this fern at Simla, where it is very abundant on Jako mountain, and he was at first inclined to make two varieties besides the type; but in his finally printed list he gave that up. He says *P. clathratum* is quite distinct from both *P. lineare* and *P. simplex*, though it often grows with the last-mentioned, which it much resembles in texture and mode of growth. "The sori," he says, "are small, frequently oblong, of a bright orange colour, and sometimes confluent. . . . . . The stipes are generally shorter, and the fronds longer and more linear than in the specimen figured by Clarke." The sori are sometimes very large, *e.g.*, in a specimen of MacLeod's from Kashmir they are one-eighth of an inch in the largest diameter, and more than one-quarter the width of the frond: these are full of scales. This species is not got in Mussooree, where both *P. lineare* and *P. simplex* are very common.

P. alberti, Regel—Descr. Pl. nov., No. XVIII, 122, from Turkestan, is exactly the same as a small form, called *P. clathratum*, from the Himalaya at high altitudes, which might perhaps be separated and put under *P. alberti.*

28. **P. membranaceum**, Don, β., *P. grandifolium*, Wall.; Syn. Fil. 360; *P. membranaceum*, Don, C. R. 560. *Pleopeltis membranaceum*, Don, Bedd. H. B. 355.

KASHMIR: Tawi Vy. 4-5000′, Trotter.

PUNJAB: *Chamba State*—Chenab Vy. 5000′, McDonell: "not common"; Kangra Vy. Dist.—*fide* Trotter; *Simla Reg.*—Simla, common.

N.-W. P.: *D. D. Dist.*—in the Dún: Nalota Khála and elsewhere at the foot of the Himálaya, 2500′ and upwards; Mussooree 5-7000′, on moist rocks, and trunks of trees, common; *T. Garh.* Aglár Vy. 4-5000′, Duthie; *B. Garh.*—Mrs. Fisher; *Kumaun*—Mohargiri 6500′, S. & W.; Naini Tál 6500′, on rocks by the Lake, Hope 1861: not seen there in 1890 and 1894; elsewhere 25-5000′, widely distributed.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán; Assam—Khasia Dist. 2-5000′: very common; Bengal—Parasnáth Mt. 3000′, *Clarke.* S. Ind.—E. & W. Mts., 2-5000′. Ceylon. Tonkin. W. China—Yunnan, *Henry.* Philippines.

Usually large; but I have a fertile frond gathered in Kumaun, only 5 inches high, including the short stipes. All the specimens I possess seem to belong to Wallich's *P. grandifolium*, which is said to have sori smaller, and irregularly scattered.

29. **P. heterocarpum**, Bl. (non Mett.); β., *P. Zippellii*, Bl., Syn. Fil. 360; *P. Zipellii*, C. R. 561. *Pleopeltis Zippellii*, Bl., Bedd. H. B. 357.

PUNJAB: *Chamba*—Dalhousie, Col. Dyas, *fide* Bedd. in H. B.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán, 2-6000′, common; Assam—Khasia, 2-4000′, frequent, W. Manipur 1000′, *Clarke*. Ceylon. Malay Penins. Perak. Sumatra. Java. Borneo. Philippines. China—Yunnan, *Henry*.

I give this as a North-West Indian species solely on the authority of Colonel Beddome. Mr. McDonell, who lived for years in Chamba, close to Dalhousie in charge of the forests, never found it there. I do not think the habitat, "N. India," in the '*Synopsis*,' means including N.-W. India any more than it does when given for *P. iridiodes*, Lamk., the next N.-E. Indian species, or for *P. hemionitideum*, Wall.

30. **P. oxylobum**, Wall. Cat. 294. *P. trifidum*, Don, Syn. Fil. 363; *P. hastatum*, Thunb. var. 2 *oxyloba* (sp.) Wall., C. R. 563. *Pleopeltis hastata*, Th., Bedd. H. B. 362; *Pleopeltis trifida*, Don, Bedd. Suppt. H. B. 96; *Pleopeltis laciniata*, Bl., Bedd. in Journ. Bot., Aug. 1892.

PUNJAB: *Chamba*—Dalhousie, McDonell: "abundant"; *Kangra Vy. Dist.*—Dharmsála 5000′, Trotter; *Simla Reg.*—Simla 6200′, Blanf.: "very rare. In fact I know of only one locality for it, near Simla"; Simla—3 stations, Bliss; *Bisahir*—Taklech 5000′, Lace.

N.-W. P.: *D. D. Dist.*—Sowarna Nála 4500′ ? ; Badráj Mt. and 'The Park', on the Mussooree Ridge, Mackinnons 1878-79; 'The Park' 6300′, on trees, Hope 1887 and 1895; The Castle Hill 6100′, A. Hope 1885; C. W. Hope 1892 and 1895, in quantity, on a rock; *T. Garh.*, Ganges Vy. 7-8000′, Duthie 1881; Dura 5000′, Gamble 1893; *B. Garh.*, Mrs. Fisher; *Kumaun*—R. Blink 1827; Binsar 7000′, S. & W.; near Naini Tál, Hope 1861, Nalena Vy. 4700′, Hope 1890; above Loharkhet 75-8000′, Trotter 1891; Kála Muni Ridge 8500′, MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepal *Wallich*; Sikkim and Bhotán: not common; Assam—Khásia Dist. 2-6000′: common, Kohima 6000′, *Clarke*. S. India—5000′-8600′. Ceylon, *Mrs. Walker*. China—Yunnan, *Henry*. Japan.

A thoroughly good species, in my opinion.

31. **P. malacodon**, Hook.; Syn. Fil. 363; C. R. 564. *Pleopeltis malacodon*, *Hook.*, Bedd. H. B. 363.

PUNJAB: *Kullu*—Jalori Pass 10000′, Rohtang Pass 10-13,000′, Trotter 1887; *Simla Reg.*, Bates; Kamalhori and Hattu Mts. 9-10,500′, on rocks, Gamble, Collett, Hope, Trotter, Bliss.

N.-W. P.: *T. Garh.*—not infrequent at 9-13,000′ alt., Mackinnons, Duthie, Herschel, Gamble; *B. Garh.*—near Ramri 9-10,000′, and above it 12,000′, Duthie; *Kumaun* Sarju R. 4500′, and Kala Mundi Pass 8000′, S. & W.; Kali Vy. 12-13,000′, Duthie; Pindar Gorge 10,000′, Trotter.

DISTRIB.—*Asia*: N. Ind. (Him.) 9-13,000′, Nepál to Bhotán.

Mr. Clarke says:—"A very common fern, known at once by its strongly serrate margin. It is remarkable that I find no example in the Kew Herbarium (other than my own) except some pieces mixed on a sheet of T. Thomson's, said to have been collected top of Hattu, alt. 10500′, in the North-West Himalaya." But Mr. Clarke restricted the range of habitat to 'Nepal to Bhotan'. Hattu Mt. is now a well-known habitat for *P. malacodon*: it was got there in 1876 by

Gamble, and in 1878 by Collett ; and, as will be seen above, the fern grows in many other places west of Nepál.

The scales of the rhizome have not been correctly described by Baker or Clarke : they are not " brown or nearly black," or " brown black." They are bicoloured, *i.e.*, pale-brown with a broad dark-brown streak down the centre. Clarke says—" Frond often sub-cordate at base." Among the numerous specimens in Gamble's and my collections I cannot find a frond that is not cordate or sub-cordate below. Many examples have sori oval or oblong, the major axis directed towards the margin. Some of Duthie's specimens from British Garhwal, 12,000′, have sori biserial between the veins, often confluent. These grew on trees ; but elsewhere, so far as I know, the fern is always on rocks. I can see no resemblance to, or affinity with, *P. oxylobum.*

32. **P. cyrtolobum**, J. Sm., C. R. 563. *Pleopeltis Stewartii*, Bedd., Syn. Fil, 2d. ed. 573. *Pleopeltis malacodon*, Hook., var. *β. majus*, Bedd. H. B. 363, and Suppt. 96.

PUNJAB : *Chamba*—MacDonell ; *fide* Beddome in Suppt. H. B.

N.-W. P. : *D. D. Dist.*—Mussooree, " The Park " 63-6500′, Mackinnons 1880, Hope 1887 and 1895 ; *Kumaun*—Binsar 7500′, S. & W. ; Gori Vy., 7-8000′, Trotter 1891 ; Mangalia Gor 10,000′, MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.) Nepál to Bhotán 9-12,000′ : very common, *Clarke* ; Assam—Jakpho Mt. 8500′ *Clarke* ; Khasia Dist. 5000′, *Clarke.*

This species is not in McDonell's List of Chamba Ferns, and I have seen no specimen from the westward of Mussooree. Trotter in his printed list said he had a Chamba specimen from McDonell ; but the species does not appear in his later MS. list given to me ; and I have four fronds of *P. oxylobum* marked by him *P. cyrtolobum.*

I am not much surprised that writers with a tendency to unite species, and who have not seen this growing in its natural habitats, thinking it a form of *P. malacodon*, at least if they can get over the marked differences of cutting and scales of rhizome. But, having seen *P. malacodon* growing only on rocks in the Simla Region, at high elevations, and *P. cyrtolobum* growing only on trees in Mussooree, at a much lower elevation, and having observed their very different habit and appearance, I cannot hesitate to agree with Clarke in separating them. The scales of the rhizome are bicoloured like those of *P. malacodon*, but they are much narrower and darker coloured, and they end in long thick hairs. The frond is less cordate at the base, and sometimes quite decurrent on the stipes ; and the texture is much thinner than that of *P. malacodon.* The fronds vary from occasionally simple to three-lobed, and to three pairs of lobes, besides the long terminal lobe. Major MacLeod's two fronds in my possession, from Kumaun, are—one, trilobate, and the other, with stipes over 4 in., has a frond 10 in. l. with 4 pairs of lobes—the longest nearly 6 in. l. A frond from Mussooree is nearly 12 in. l., with terminal lobe all but 8 inches.

33. **P. Stewartii**, C. B. Clarke, in Trans. Linn. Soc., 2d. Ser., Bot., Vol. I., 563—the 'Review.' *Pleopeltis malacodon*, Hook., *P. Stewartii*, Clarke : a variety less serrated, Bedd. H. B. 363.

PUNJAB : *Chamba*—Ravi Vy., below Sach Pass, 9500′, McDonell 1882 ; 9900′, J. Marten 1898 ; *Simla Reg.*—Simla, near the Tunnel 7400′, Bliss 1886-90-92.

N.-W. P. : *D. D. Dist.*—Seals' Hill, E. of Landour, 7000′, Miss Parrott (by whom indicated to Hope) 1887 ; Hope 1895 : *Kumaun*—Binsar 7000′, S. & W. ; top of Liria Kánta Mt. about 8000′, Hope 1861 ; Summit of Dhankuri Pass 10,500′ and Phurki, Trotter 1891.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim 12-13,000′, Lachen, *Sir L. D. Hooker*. China—*Henry*.

Beddome meant, I think, *P. cyrtolobum* as having been collected in Garhwál by (Dr.) Stewart, as this statement is made with reference to the fern depicted in his Plate 204 in F.B.I., which seems to be *P. cyrtolobum*. Clarke wrongly referred to that Plate under his *P. Stewartii*. This species hardly grows so large as its congeners do, and it is a stiffer plant—subcoriaceous in texture : the fronds do not hang down, but stand up, or spread out, if growing on the face of a rock. The paler scales on the rhizome distinguish it. It seems a rare plant. As to the Simla Region, Blanford says :—" Very rare, and has found atbeen only one place near Simla, on rocks at an elevation of about 7400 feet."

34. **P. ebenipes**, Hook.; Syn. Fil. 365 ; C. R. 564 ; *Pleopeltis ebenipes*, Hook., Bedd. H. B. 363.

PUNJAB : *Chamba*—McDonell, *fide* Trotter ; J. Marten 1898 ; Kullu 9-10,000′, Trotter ; *Simla Reg.*, on ridge east of Simla 8-10,000′. T. T., Edgew., Bates, Blanford, Hope, Trotter, Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar—Harianta 8500′, Gamble 1895 ; *T. Garh.* Nag Tiba Mt. 9000′, Mackinnons ; under Bandarpunch 10-11,000′, and Bok Mt. 9-10,000′, Duthie ; *B. Garh.* 6-7000′, on trees, Duthie, Mrs. Fisher ; *Kumaun*—Kalamundi 8700′, S. & W., Dhankuri Pass 8-8500′, Trotter, Kala Muni and Mangalia Gor Ridges 8-10,000′, MacLeod.

DISTRIB.—*Asia* : Tibet—Yatung, *Hobson* ; N. Ind. (Him.), Sikkim and Bhotán.

Besides the broad, black, opaque, polished scales on the rhizome a marked distinction between *P. ebenipes* and its congeners is the much greater number of lobes, and consequently the longer frond ; the number of lobes seems to be 7-13 pairs. There are no fronds of *ebenipes* decurrent at base in Gamble's and my collections. Otherwise, Beddome's remarks as to the distinctions between members of this group seem good.

Subgenus PLEOPELTIS, *H. & B.*

35. **P. juglandifolium**, Don ; Syn. Fil. 368 ; C. R. 566. PLEOPELTIS, Bedd. H. B. 308. *Polypodium capitellatum*, Wall. Cat. 306.

PUNJAB : *Simla Reg.*—Simla, Lady Dalhousie 1831 ; Bisáhir, Taklech 5000′, Lace.

N.-W. P.: *D. D. Dist.*—Landour 7000′, Colonel Wilmer (comm. to Mackinnons 1878); Seal's Hill, E. of Landour, Hope 1887 and 1895; *T. Garh.*—between Ora and Ramsarai, Duthie's collr. 1879; between Betwari and Dangulla 5-6000′; 7-8000′, Duthie 1881; Kidarkanta; Jodargádh Waterfaff and rocks near Suránu-ka-Ser 6000′, Gamble 1898; *B. Garh.* 7-8000′, Duthie 1885, and Mrs. Fisher; *Kumaun*—Sarjn R. and Pass to Mohargiri, S. & W. 1848; Naini Tál 7000′, on trees, Hope 1861; Goriganga Vy. 6-8000′, MacLeod 1893.

Distrib.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim and Bhotán; Assam—Khasia 2000′-5000′, very common, *Clarke*; Kohima—Jakhpo Mt. 7500′, *Clarke*; Manipur 7500′. Burma—Moulmein, China—Yunnan, *Henry*, Yunnan—Mengtez, *Hancock*, "very rare."

Perhaps the omission of localities for the type, from Beddome's Handbook, is due to a misprint. None of the specimens I have from N. and W. India are petiolate, and otherwise they seem quite normal. At Naini Tál I used to see this fern growing on trees. At Mussooree (Landour) it grows in dense masses on a steep bank, under scrub forest, the fronds hanging down gracefully. In Kumaun MacLeod found it growing in large overhanging masses on precipitous rocks. I have a frond, Trotter's No. 959, 1891, from near Naini Tál, named by him *P. jimalayense*, Hk., which I now think is *P. juglandifolium* var. *biserialis* of Clarke, which was got in Kumaun long ago, *vide* a specimen in the Kew Herbarium. The form *B. P. tenuicauda*, Hk., does not appear to have been got in N.-W. India.

36. **P. Lehmanni**, Mett.; Syn. Fil. 369; C. R. 566. *Pleopeltis*, Bedd. H. B., 370.

N.-W. P.: *B. Garhwál*—near Ramri 12,000′, on rocks in forest, Duthie No. 5177, 1885; loc.? P. W. Mackinnon; Mrs. Fisher.

Distrib.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim 4-8000′, common, *Clarke*. Burma. China—Yunnan, *Delavay*, *Henry*.

Duthie's plant from British Garhwal is a remarkable sport. The specimen he gave me is one frond, with three inches of rhizome sending out side-shoots. The scales are typical. The stipes is 5½ in. l.—the frond 10 in. l., 8¼ in. br.: pinnæ 5 pairs, sessile, lowest 4½ in. l., and next 3 pairs not much shorter: all, and the terminal pinna, have the veins irregularly prolonged, so that the lowest pair of pinnæ are in places 3 in. br.: the pinnæ are very opposite and very acuminate. There is a similar specimen in Kew, also from Duthie. No fertile fronds of this were found by Mr. Duthie. I have lately received from Mr. Gamble two fronds, quite typical, collected in British Garhwal by Mrs. Fisher, with pinnæ very opposite and very acuminate. Mr. Mackinnon's specimens want rhizomes; but I have other grounds for believing this species grows in Garhwal, for fronds of what I could only so name grew up from among a mass of rhizomes of—I forget what other species—which the Mackinnons brought from an inner range of the Himalaya, and had in cultivation at Mussooree, about 1881.

Genus 28. NOTHOCHLAENA, *R. Br.*

1. **N. vellea**, R. Br., Prod. 146 ; *N. lanuginosa*, Desv., Syn. Fil. 370. *N. vellea*, R. Br., Bedd. H. B. 375.

AFGHAN. : Griffith, in Herb. Hort. Kew ; see also Baker in Ann. Bot. V., No. XVIII.

KASHMIR : *fide* Beddome in Handbook.

PUNJAB : *Chamba*—Ravi Vy., below Pokri, 3500' and under : "also found in other places at 3500' or so," McDonell 1882 ; "Chamba", 3000'. J. Marten 1897 ; Kangra Vy. Dist.—Lahaul, *fide* Bedd. H. B., Pángi and Lahaul, 9-12,000', Dr. Watt, in Herb. Hort. Kew.

DISTRIB.—*Eur.* : Spain, Sardinia, Italy, Sicily, Greece, Crete. *Asia* : Syria ; S. Persia, *Dr. Stapf* ; E. Persia, *Bornmüller*. *Australia* : temperate and tropical. *Afr.* : Macaronesian Isles, S. Morocco, *J. D. Hooker*, Algeria, Nubia.

I think this fern was found in Chamba (or Kashmir) by Mr. Ellis before Mr. McDonell found it. Mr. McDonell did not know it, and sent it to Mr. Levinge, and to me—or Levinge sent it to me. Levinge marked it "Woodsia sp."? I recognised it as *N. lanuginosa* from a coloured drawing in 'Britten's European Ferns.'

Mr. Marten has quite lately found it in the Chamba State.

2. **N. Marantae**, R. Br. ; Syn. Fil. 371 ; C. R. 567 ; Bedd. H. B. 373.

KASHMIR : *fide* Clarke in 'Review.'

PUNJAB : *Chamba*—Ravi Vy., Thála 11,000', McDonell 1885 ; *Kullu*, summit of Jalori Pass 10,500', Trotter ; *Simla Reg.*—ridge E. of Simla 8000' to 10,200', Bates, Blanf., Hope, Trotter, Lace, Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar 9000', Rogers ; *T. Garh.*—Nag Tiba Mt. 9-10,000', Mackinnons ; Deota 8000', Gamble 1893 ; Balcha, Rogers ; Jamnotri 10-11,000', Duthie 1884 ; *B. Garh.*—above Ramri 8-9000', Dombitia Gádh 9000', Kuari Pass 11-12,000', Duthie ; *Kumaun*—S. & W., Kali Vy. 9-10,000', Duthie and J. R. Reid, Pindar Gorge 8000', Trotter.

DISTRIB.—*Eur.* : The Continent throughout the Mediterranean Region, extending to the Tyrol and Hungary, and to Ardêche and Portugal : in Spain upon the mountains up to 3000'. *Asia* : Syria and Tauria ; Tibet—Yatung *Hobson* ; N. Ind. (Him.) Sikkim—Lachen Vy. 9-15,000', *Hook. Fil.* ; *Dr. King's collr.* 14,000'. *Afr.* : Macaronesia, Barbary States and Abyssinia.

Genus 29. GYMNOGRAMME, *Devo.*

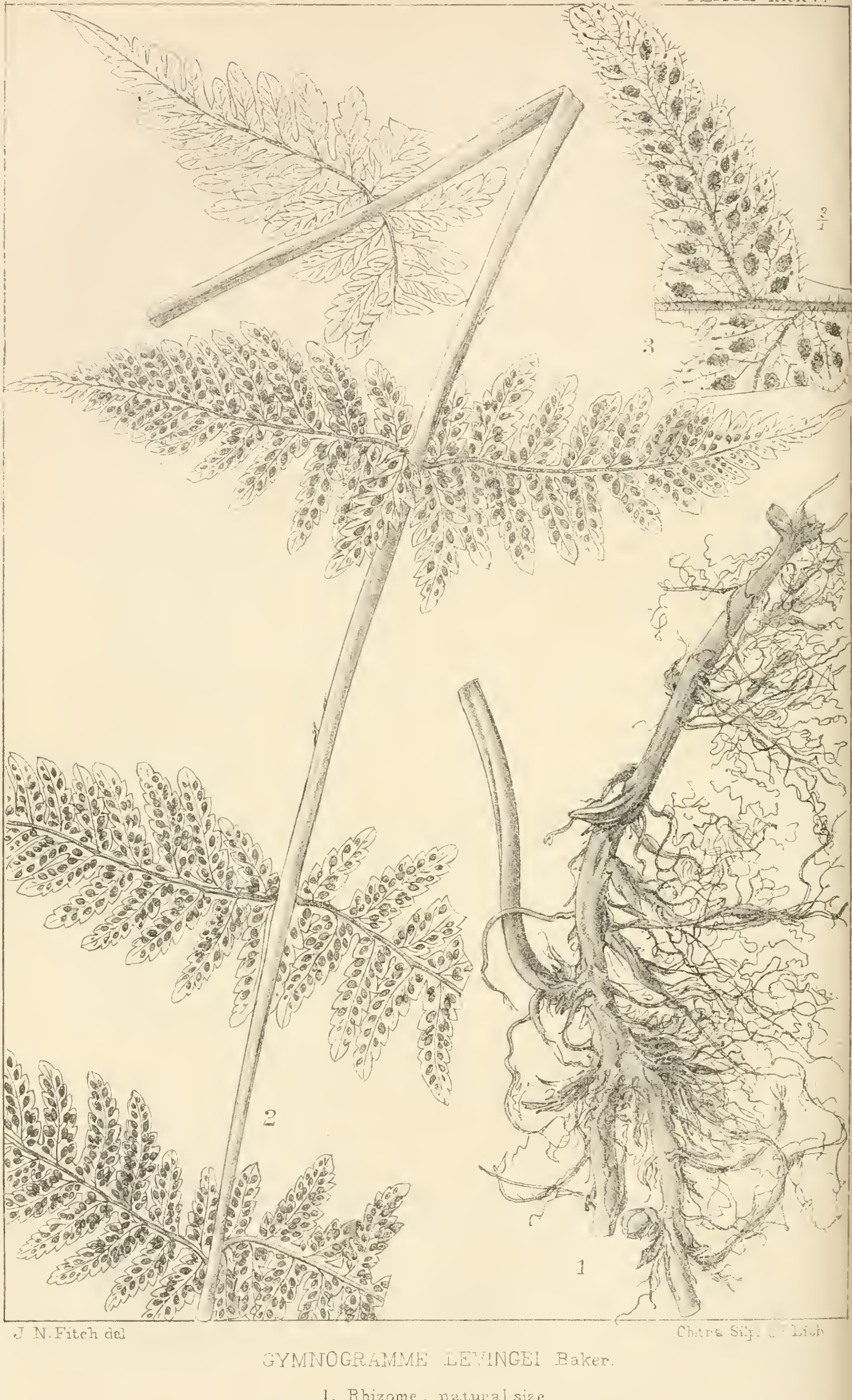
Subgenus LEPTOGRAMME, *J. Sm.*

1. **G. Totta**, Schlecht ; Syn. Fil. 376 ; C. R. 567. *Leptogramme Totta*, Schlecht., Bedd. H. B. 377.

KASHMIR : *fide* Clarke in 'Review.'

PUNJAB : *Chamba*—Ravi Vy. 6000', McDonell ; *Kullu*—Outer Seoráj 7000', Trotter, 6-8000', Coventry ; *Simla Reg.*—The Chúr (or Chor) Mt. Herschel ; Simla—Bliss 1886-90-92.

N.-W. P. : *D. D. Dist.*—Jaunsar, Harianta 7000', Kathián 7500', Gamble ; *T. Garh.*—Cháchpur Vy. 6000', Duthie ; P. W. Mackinnon, very long ; *Kumaun*—T. T. ; Jagesar 6000', S. & W. ; Edgew., Hawalbágh, in Herb. Sahar. ; Davidson ; near Devidhura 6000', Trotter.



J. N. Fitch del

Chitra Silpi & Lith

GYMNOGRAMME LEVINGEI Baker.

1. Rhizome, natural size
2. Lower portion of frond; natural size.
3. Portion of a pinna, enlarged 2 diam.

DISTRIB.—*Asia* : N. Ind., Assam *Griffith* ; Khasia 3-5000′, common, *Clarke.* S. Ind.—very common on west side, at highest elevations, *Beddome.* Ceylon. Sumatra and Java. Japan. China. Korea. *Afr.* : Macaronesia ; Guinea Coast ; Fernando Po, and Kamerun Mts., G. Mann. Abyssinia. Cape Colony. Comoro Islands.

2. **G. Levingii**, Baker, in Annal. Bot., Vol. V., No. XVIII., 216. *G. aurita, var. Levingii*, C. R. 568. *Leptogramme aurita, var. Levingii*, Clarke, Bedd. H. B. 379 ; *Leptogramme Levingii*, Bedd. Suppt. H. B. 99.—Plate *XXXV.*

The following is Mr. Baker's description of the Plant :—

" Rhizome slender, wide-creeping ; paleæ lanceolate, membranaceous. Stipe slender, naked 6—8 in. long, stramineous, with a brown base. *Frond* lanceolate, or oblong-lanceolate, bipinnate, membranous, pubescent, 1—1½ ft. long, 3—4 in. br. at the middle, narrowed to the base. *Pinnæ* lanceolate, sessile, ½—¾ in. broad, cut down to the rhachis into continuous erecto-patent, linear-oblong *pinnules.* Veinlets erecto-patent : upper simple, lower forked. *Sori* oblong or globose, placed nearer the margin than the midrib. West Himalayas ; Jhelum Valley, alt. 4000′ ; Levinge. I follow Mr. C. W. Hope in treating this as a species."

Mr. Clarke, in giving this fern as a variety of *G. aurita*, Hook., said—" It has the texture and hairiness of *G. Totta*, but the rhizome and venation of *G. aurita* ; while the cutting is deeper than that of *G. Totta*, less auriculate than that of *G. aurita*."

I will not attempt to check the various descriptions of the plant, for it might end in writing another, and there are already enough ; but I figure it, as that has not yet been done.

KASHMIR : Palgam 8000′, C. B. Clarke. *Gilgit Dist.*—Dashkin 7500′, Dr. Giles ; Jhelum and Chitapáni Vys. 4-7000′, Levinge 1875 , Gulmarg 75-8000′, Sind Vy. 7000′, Trotter ; Pir Punjal—Hirpur 7000′, Sind Vy., Gund, 6000′, Gammie ; Farikand Nála 6-7000′, MacLeod—" on the edge of the stream, not under shade. Does not grow away from water."

PUNJAB : *Hazára Dist.*—Kagán Vy., Inayat (Sahar. Herb. collr.) 1899 ; *Chamba*—above Alwás, and Sach Vy. 8000′, McDonell ; " Chamba," J. Marten 1898, Pángi 8500′, Harsukh (Sarhar. Herb. collr.) 1899 ; Kullu, Trotter in List ; *Simla Dist.*—eastward from Simla a ridge, near Theog 8000′, Kamalhori and Hattu Mts. 85-9400′, Hope, Blanford, Bliss, Dr. Watt. Kunáwar, T. T. 1847.

N.-W. P. : *D. D. Dist.*—Jaunsar (or *T. Garh.*) : Collected on march from Mussooree to Chakrata, Mrs. J. Sladen, 1880 ; *T. Garh.*—Nag Tiba Mt., Mackinnons 1879 ; Ganges Vy., below Harsil and Derali 8-9000′, Duthie 1881 ; Mandraoli 10—11000′, Duthie 1883 ; *Kumaun*—between Gini and Munshiari 7-8000′, Dhauli Vy. 9-10000′, Duthie " *Kumaun*," J. R. Reid 1886.

This fern varies a good deal in shape and cutting of frond. I had a frond 10 in. l., but only 2½ in. br., and another (Hattu Mt., Bliss) which is 18⅔ in. l. by 7¾ in. br. The greatest width Baker gives is 4 inches, and Beddome—

5½. The rhizome is very slender, and in general not thicker than the stipes. My observation bears out Blanford's and MacLeod's statements as to its love for water or wet ground. Blanford considered this a good species.

Subgenus EUGYMNOGRAMME.

3. **G. vestita**, Hook. ; Syn. Fil. 379. Subgenus SYNGRAMME, *G. vestita*, Hook. C. R. 568. *Syngramme vestita*, Wall. Cat. 12 (under *Grammitis*), Bedd. H. B. 386.

PUNJAB : *Hazára Dist.*—Black Mt. 6900′, Trotter ; *Chamba*—McDonell, 1885 or previously ; *Mandi State*—near Badwáni 7000′, Trotter 1887 ; *Simla Reg.*—Simla 55-7000′, frequent ; eastward along ridge, to Kamalhori Mt. 8-9000′, Bates, Gamble, Blanford, Hope, Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar, Lokandi 7000′, Konain 7000′, Gamble ; Lakhwá, Gammie, "Jaunsar" Mrs. Stansfield 1883 ; Mussooree 6500′, Mackinnons 1878-79 ; *T. Garh.* Kidar Kánta Mt. Dr. Royle, and eastward from Landour, 7-7500′, Levinge 1872 ; Deota 6000′, Gamble ; Ganges and Jumna Vys. 7-9000 Duthie ; *B. Garh.* 6-7000′, Duthie ; near Joshi Matt, Mackinnons ; Mrs. Fisher ; *Kumaun*, Wallich 1829 (R. Blink.) in many places—55-8000′, S. & W. ; Edgew., Hope, Davidson, Duthie, Trotter, MacLeod, 1861 to 1893.

DISTRIB.—*Asia* : N. India (Him.) Bhotán. China, North and South.

The rhizome is procumbent, slow growing.

The pinnæ in large specimens become bluntly auricled at base on the upper side, or on both sides—sub-sagittate.

4. **G. Andersoni**, Bedd., Ferns of British India, p. , t. 190 ; Syn. Fil. 380 ; C. R. 568 ; *G. Andersoni*, Bedd. H. B. 382.

N.-W. P. : *T. Garh*—Gumbar Pass 12-13,000′, Duthie ; *B. Garh.*—near Kuari Pass 11-12,000′, Duthie ; *Kumaun*—Pindari 12,000′, S. & W. (*Woodsia mollis* on ticket) ; above Namik 11,000′, No. S, 695, F. ; Sundadunga Vy. 13,000′, Dr. Anderson ; Káli Vy , above Garbyáng 11-12,000′, Duthie, Byáns—above Chalek 11-13,000′, and Palang Gádh 11,000′, Duthie.

NEPAL W. : Nampa Gádh 11-12,000′, Duthie.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim 14-16,000′, *Hook. Fil.*

" *Woodsia lanosa*, Hook., must be placed here as a synonym " : Baker in Ann. Bot., Vol. V., No. XVIII.

5. **G. javanica**, Bl. ; Syn. Fil. 381 ; C. R. 569. (Subgenus *Syngramme.*) *Syngramme fraxinea*, Don (under *Diplazium*), Bedd. H. B. 386.

KASHMIR : Rattan Pir 75-8000′, Trotter ; Dardpura and Audr'bng 6000′, common, MacLeod.

PUNJAB : *Hazára Dist.*—Murree, Hope 1882, Trotter 1886 ; *Chamba State*—Kalatop Forest, 6-7000′ and upwards, MacDonell; 5-7000′, J. Marten 1897 ; Kangra. Vy. Dist.—Dalhousie, C. B. Clarke ; *Simla Reg.*—Simla and eastward along Thibet Road, 5-10,000′, common in forest, Edgew, Madden, Hope, Gamble, Blanford, Trotter, Bliss. Giri Vy.—Raiengarh Forest 7000′, Gamble.

N.-W. P. : *D.D. Dist.*—Jaunsar, Mandáli 8000′, Gamble ; Mussooree 4-5000′, several stations, Duthie, Mackinnons, Hope ; *T. Garh.* Srinagar, R. Bl., Bok and Nag Tiba Mts.

9-10,000′, Mackinnons, Duthie; Bambu Vy. 6000′, Gamble; *B. Garh.* Mrs. Fisher; *Kumaun*—near Kháti 7200′—7800′ (both forms) S. & W.; near Naini Tál 45-6000′, Hope, Konoor 7000′, Davidson; near Bugeswar 3500′; Dhankuri 9000′, Trotter; Sarjuganga Vy. and elsewhere, 2-6000′, MacLeod.

NEPAL, *Wallich*, Centr. Nepàl, *Scully*.

DISTRIB.—*Asia* : N. Ind. (Him.) E. Nepâl *J. D. Hooker* ; Sikkim and Bhotán ; Assam—Khasia Dist. 1-5000′, common. Burma—Tenasserim. Ceylon—5-6000′. Malay Penins. and Isles. Tonkin. Phillipines. China—Shensi, Giraldi ; Nau-T. *Henry* ; Yunnan, *Delavay*, *Hancock* ; Shing-King Prov., between Mukden and Kirin, *James*. Japan. Polynesia. *Afr.* : E. & W. Tropical ; Kamerun Mts., Fernando Po, St. Thomas. Madagascar.

Beddome describes two forms—pinnate and bipinnate ; but plants of a form between these two are frequent, *i.e.*, with perhaps only one pair of pinnæ pinnate, and that irregularly so ; and there is also a tripinnate fern, as Blanford pointed out. The simpler forms generally grow at low levels, and have large, broad, pinnæ and the compound forms always at high altitudes, with small narrow pinnules. The number of pinnæ varies greatly.

Looking to the contrast which the low-level form—with stout stipes and rhachis, and large, simple pinnæ, or with only the lowest pair pinnate or partly so —presents with the high level form, bi- or tri-pinnate, with slender stipes and rhachis, and with small, narrow pinnules, and also to the differences of margin, I am not surprised that several species have been made out of this plant ; but I do not think this is necessary. Blanford says :—" Below 6000′ it is bipinnate only as regards the lowest pair of pinnæ and the pinnules are broad and large. Specimens from higher elevations have several pairs of pinnæ again pinnate, and the pinnules are smaller and narrower. It is often 3-pinnate." This is well expressed ; but the purely simply pinnate form is not mentioned. The venation varies : in some fronds the veinlets stop short of the margin, and are thickened (clubbed) at the ends, the marginal teeth in that case being quite disconnected from the veins : in most cases the veinlets run into the teeth, and quite to the margin. The anastomosis of veinlets of contiguous groups is, as Beddome says, rare, and I have detected it in only 3 out of 25 fronds. The re-uniting or looping of forked veinlets within the same group is commoner. The veinlets get so close towards the margin that I wonder how, in the simpler broad segment form, they keep separate.

6. **G. leptophylla**, Desv. ; Syn. Fil. 383 ; Bedd. H. B. 382, and Suppt. 100.

N.-W. P. : *D. D. Dist.* Mussooree, Dr. Bacon : in Herb. Hort. Kew ; *Kumaun*—Colonel Davidson 1877, in Herb. Hort. Saharanpur : also in Herb. Hort. Kew.

DISTRIB.—*Amer.* : Andes of Mexico and Ecuador ; Paraguay. *Eur.* : Jersey, France ; Switzerland ; Spain and Portugal, Italy and Sicily, Corsica and other Mediterranean Islands, Greece, Turkey. *Asia* : Persia. S. Ind.—W. Ghâts, Ootacamund, Mahableshwar, Satâra Fort walls. Ceylon—*Trimen*. Australasia—N. S. Wales, Tasmania and N. Zealand. *Afr.*; Macaronesia, Barbary States and Abyssinia; Cape Colony and Madagascar.

This species, and two others, are annual, and form the genus *Annogramma* of Link. (Syn. Fil.) Mr. Marquand, a well-known authority on *Algæ*, tells me that *G. leptophylla* is in some years plentiful in Jersey, and sometimes comparatively rare.

Subgenus SELLIGUEA, *Bory*.

7. **G. involuta,** Hook.; Syn. Fil. 387; C. R. 570. *Loxogramme involuta*, Don (under *Grammitis*), Bedd. H. B. 393.

PUNJAB: *Simla Reg.*—Simla 5-6000′, Lady Dalhousie, Hope, Blanford, Trotter, Bliss.

N.-W.-P: *D. D. Dist.*—Mussooree and neighbourhood, in various places 47-6500′, on trees, Edgew. Duthie, Mackinnons, Hope; *T. Garh.*—Phedi 4-5000′, Duthie; *B. Garh.*—below Kinoll 5000′, Duthie; Mrs. Fisher, *Kumaun* 4-8500′, on trees and rocks: plentiful in some places, R. Blink., S. & W., Hope, Davidson, Duthie, MacLeod

DISTRIB.—*Asia*: N. Ind. (Him.) Nepâl *Wallich*, Sikkim and Bhotán; Assam—Khasia Dist. 1-5000′, very common, N. Manipur 5500′, *Clarke*. S. India—5-8000′, Ceylon 5-8000. Malay Penins.—Penang, *Wallich* 1822. China: Yunnan—Mengtez, *Hancock*, *Henry*; Szechwan *Faber*. Philippines, Polynesia—Solomon Isles.

8. **G. elliptica,** Baker; Syn. Fil. 389; C. R. 570. *Selliguea elliptica*, Thunb., Bedd. H. B. 392.

N.-W. P.: *D. D. Dist.*—Sowarna Nadi, 4500′, Mackinnons 1878-79, P. W. Mackinnon and Hope 1881; in the Dún—Nalota Khâla 2500′, Hope 1881, 1889, and 1891: station shown to A. Campbell, Trotter, and Gamble in 1891.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán; Assam—Khasia Dist., 2500′-5000′, very common, Kohima 45-6000′, *Clarke*, N. Manipur 4500′, *Clarke*. Burma—Tenasserim Prov. Malay Penins. Tonkin. Philippines. Japan. China. Formosa. Australia—Queensland.

I think it is a mistake to put this species, as Baker and Beddome do—* * Fronds compound;—there is always a wing, though sometimes nearly interrupted, to the main rhachis in even the longest and most developed fronds; and Thunberg's name, *elliptica*, and Presl's—*decurrens*, seem to imply this. The fronds are as much a-pinnate as are those of the series of *Polypodium* (Phym.) from *oxylobum* to *ebenipes*; but the main veins or secondary rhachises are stouter than those of the *Polypodiums*. Baker says—" Oldham gathered in Formosa a form with the fronds quite entire," and Clarke says he has an example, in full fruit, quite simple. I have some fronds, gathered in the Dehra Dún from young rhizomes, which are 2—3 in. l., quite simple, but sterile, and I think this simplicity goes to prove that the plant has not pinnate fronds.

A specimen of *G. elliptica* from the Dehra Dún has stipes 13½ in. l., and frond 16 × 11 in.: it has 7 pairs of lobes, and a terminal. This fern, when dried, tinges paper pink, as does also *Asplenium ensiforme*.

Genus 30. VITTARIA, *Sm.*

Sub-genus TÆNIOPSIS, *J. Sm.*

1. **V. lineata,** Sw. ; Syn. Fil. 396. *V. flexuosa,* Fée, C. R. 574. *V. lineata,* Sw., Bedd. H. B. 407.

PUNJAB : *Kangra Vy. Dist.*, Mr. D. Macdougall, *fide* Trotter in printed List.

N.-W. P. : *D. D. Dist.*—Vicary, in Herb. Hort. Sahar. ; *T. or B. Garhwal* 4-5000′, P. W. Mackinnon 1881 ; *B. Garh.* 7-8000′, Duthie 1885 ; *Kumaun*—Sarju Vy. 4800′, S. & W., above Gini 6-7000′, near Sosa 9-10,000′, in forest, on *Abies dumosa,* Duthie 1884 ; near Kháti 7500′, and above Loharkhet 8-8500′, Trotter 1891 ; above Girgaon 9500′, "common trees," MacLeod 1893.

DISTRIB.—*Amer.* : W. Indies and Florida to Peru and Brazil ; Brit. Guiana—Roraima. *Asia* : N. Ind. (Him.), Sikkim and Bhotán : "2-12,000′, very common," *Clarke* ; Assam—Khásia Dist. 1-6000′, very common ; Kachar ; Manipur, *Watt.* S. Ind.—on the Western Mts. 2-6000′. S. Andaman Island, *Kurz.* Ceylon, C. P., common. Malay Penins. and Islands. Tonkin—*Balansa.* China—Yunnan, *Henry, Hancock* ; Fokien *Carter.* Japan. Philippines. Borneo. New Guinea, *Afr.* : Kameruns. Guinea Coast, Ashanti. *Centr. Afr.*—Ruenzori, Zambesi Land, Natal, Cape Colony. Mascaren Islands. Sechelles.

Tribe B. ACROSTICHEÆ.

Genus 60. ACROSTICHUM, *L.*

Sub-Genus GYMNOPTERIS, *Bernh.*

1. **A.** (Gym.) *virens,* Hook. ; Syn. Fil. 420. *A. crispatulum,* Wall. Cat. 24, Clarke's Rev., p. 580, Pl. LXXXIV, fig. 2, b, d.—"Barren pinnæ numerous, often 20 or more, 4 by ½ in., slightly serrate, the midrib often reddish when dry, a series of costal arches, without included veins in any of the areolæ ; fertile pinnæ 4 by ⅛ to ⅙ in.

"Round Bengal from Kumaun to Bhotán and Chittagong in the lower hills, alt. 0-3000′, common.

"The only very common species of the group called *A. virens* by Mr. Baker. Very constant in character, and easily recognised by the absence of free veins."

N.-W. P. : *Brit. Garh.*, up to about 3000′ ; Bhainskil, near Parewa, Kotah Range, coll. Ináyat Khán (native collr. of Sahar. Herb.) 6-1902 ; *Kumaun* : R. Bl., 2 sheets in Herb. Hort. Kew.

This species is the only *Acrostichum* that has hitherto been found in N.-W. Ind.

Sub-Ord. III. OSMUNDACEÆ.

Genus 31. OSMUNDA, *L.*

1. **O. Claytoniana,** L. ; Syn. Fil. 426 ; C. R. 582 ; Bedd. H. B. 449.

KASHMIR : Gulmarg 95—10,000′, *C. B. Clarke* 1875, Levinge 1875, Trotter ; 8-9000 Duthie ; Sarpat Peak over 10,000′ : "grows in regular fields, coming up through the melting snow." MacLeod.

PUNJAB : *Chamba,* 8000′ McDonell ; Kullu, 6-11,000′ Trotter ; *Simla Reg.*—Bisahir, Chini, Vicary 1831, in Herb. Hort. Sahar. ; Bári 8000′ Lace ; Hattu Mt. 10,000′, Bates, Blanford, Hope, Bliss ; Sirmur Territory 9-10,000′.

N. W. P. : *D. D. Dist.*—Jaunsar, Molta Forest, 4-5000′, Gamble ; *T. Garh.* Deota 8000′ and Bamsu 9000′ Gamble ; Kidár Kánta Mt. and near it 10-12,000′, Col. Bailey, R. E., and Duthie ; Nag Tiba Mt. 9000′, Mackinnon's ; Deráli : Damdar Vy. 9-11,000′, Duthie ; *Kumaun*, Wallich 1829, above Namik 8500′, Rálam 12,000′, S. & W. , ascent from Ramganga R., 8500′, S. & W., Rálam Vy. 11-12,000′, Duthie ; Pindar Gorge 9-10,000′, Trotter ; Gori Ganga Vy. 10-11,000′, MacLeod.

Distrib.—*Amer.* : Canada, Newfoundland, and throughout the United States. *Asia* : (Him.) Sikkim : Lachen 9000′, *J. D. Hook.*; Bhotán *Griffith*, 6000′, *C. B. Clarke* ; Assam—Khasi Hills, *Griffith* and *T. Thoms.*

This fern grows much larger than is stated in the '*Synopsis*,' namely, st. 1 ft., frond 1—2 ft. l. I have gathered it in the Simla Region with fronds 4½ ft. long, exclusive of stipes. It unrolls its fertile fronds in May or June, and withers early.

2. **O. regalis**, L. ; Syn. Fil. 427 , C. R. 583 ; Bedd. H. B. 450.

Punjab : *Chamba State*—Ravi Vy. (Bhandál Vy.), 5000′ and over, and Langera 6000′, McDonell 1882, 7000′ ; J. Marten 1897 ; *Simla Reg.*—Simla, below 6000′, Blanford in List, 1888, "very rare, and now nearly extirpated by assiduous collectors."

N.-W. P. : *D. D. Dist.*—Jaunsar, Molta Forest 4500′, Duthie, and Gamble, 1895. *T. Garh.*—Kidarkanta Mt. 12,000′, Herschel 1879. *B. Garh*, 5-6000′, P. W. Mackinnon 1881 ; *Kumaun*, T. T., S. & W. (" L. speciosa, Wall.") ; Hawalbágh, in Herb. Hort. Sahar. "Asplenium 12 ; 25-6-49" on ticket ; Gori Ganga Vy.—Ranti 8500′, MacLeod.

Distrib.—*Amer.* : Canada and the Saskatchewan to Brazil (Rio Janeiro) *Europe* : British Isles. Sweden and Russia to Spain, Italy and Turkey, Mingrelia, *Szovitz* ; *Asia* : Siberia ; N. Ind. (Him.) Sikkim and Bhotán ; Assam—Khasia Dist. 4-6000′, "common, or at least frequent", *Clarke* ; Kohima—Jakpho Mt. 7000′, *Clarke* ; Centr. Provs. : Pachmarhi, *Duthie* ; Bombay Presy.—Mts. of Malabaria (Clarke in 'Rev.'), S. Ind., common on the W. Mts. at the higher elevations. S. & W. China ; Hongkong. Japan. *Afr.* : Azores, Algeria, Tunis, Abyssinia, Angola ; Centr. Afr., Nyassa Land, Zambesi Land. Natal and Cape Colony. Mascaren Islands.

Indian plants of this fern all seem to be small,—well within the dimensions given in the '*Synopsis*,' and copied by Beddome, namely, *st.* tufted, 12—18 in. l., *fr.* 2—4 ft. l., 1 ft., or more, broad. It is well known that the European plant grows to much longer dimensions—up to 12 ft. in height.

Baker says—" *O. japonica*, Th. (*O. speciosa*, Wall.) is a curious variety from Japan and the Himalayas, with the fertile and barren fronds often quite distinct, the former being developed the earliest, and soon disappearing. . . . . . Mr. McKen sends a similar form from Natal." And in the summary of New Ferns, 1891, Mr. Baker says—" *O. japonica* has been gathered in Angola by Mr. H. H. Johnston." Mr. Clarke says—" The common Khasi form is very small, 12—18 in. high ; the fertile and barren fronds quite separate : this is *O. japonica*, Thumb. ; *O. speciosa*, Wall. But I have collected fronds of this barren below, fertile above." This seems to be the normal, if not the only, form in Japan : I have not seen the rhizome of it.

In Chamba McDonell never got a fertile frond of *O. regalis*. In Jaunsar and British Garhwál specimens the fertile and sterile fronds are quite separate. *Duthie and Gamble* got both kinds of fronds on the same date, in May. Duthie's specimens from Pachmarhi, in the Central Provinces, India, and Gamble's from the Madras Presidency, are typical *O. regalis*, but small.

Sub-Ord. IV.—SCHIZÆACIÆ.

Genus 32. LYGODIUM, *Sw.*

Sub-genus EULYGODIUM, Veins free.

1. **L. microphyllum**, R. Br. ; *L. scandens*, Sw., Syn. Fil. 437 ; C. R. 583 ; Bedd. H. B. 455.

TRANS.-IND. STATES : *Baraul*—Ziárat Vy , 5000′, General (now Sir Wm.) Gatacre, 1895 : see "Ferns of the Chitral Relief Expedition," Journ. Bot., Vol. XXXIV., No. 379, March 1896.

DISTRIB.—*Asia* : N. E. Him., Bhotán, *Nuttall* ; Bengal Plain, rare—Cooch Behar, Sylhet, Chittagong, *Clarke*. S. Ind.—very common up to 3000′. Ceylon, abundant. Malay Penins. and Isles. S. China. Australia—Queensland. *Afr.* : Guinea Coast.

The only material from the Trans-Indus States consists of a part of a frond with only sterile pinnæ, the shape of which agrees with those of *L. microphyllum*, and they are unlike those of the other species of *Lygodium* which have been found in N.-W. India. Mr. Clarke considers *L. microphyllum* the best marked and least variable species of the genus. It has not before been found in N. India west of Bhotán, Assam, and the plain of N. Bengal. General Gatacre's plant was got in about N. Lat. 35°-25′, and E. Long. 71°-50′. Mr. Gamble agrees with me in the identification of this specimen, and says it is an interesting problem in geographical distribution—how this and *Pteris ludens* (see *supra* Vol. XIII, No. 3, p. 457), got into the Chitral Region.

2. **L. pinnatifidum**, Sw. ; Syn. Fil. 438. *L. flexuosum*, Sw., C. R. 584 ; Bedd. H. B. 457. *L. salicifolium* (Presl), Prantl, quoted by Baker in Ann. Bot., Vol. V., No. XVIII.

N.-W. P. : *D. D. Dist.*—Very common in scrub jungle and forest, 1-3000′, Mackinnons, Hope, Duthie, A. Campbell, and Gamble ; *Kumaun*—2-5000′, S. & W., Hope, Davidson, Duthie ; *Sajahanpur Dist.*, near Indalpur, Duthie 1885 ; *Gorakhpur Dist.*—Ramgarh Forest, 6 miles from Gorakhpur, A. Campbell 1887.

DISTRIB.—*Asia* : N. E. Ind. (Him.) up to 5000′ : Bengal—throughout the Plain, abundant, *Clarke* ; S. Ind., on both sides of the Madras Presy., common up to about 4000′, *Beddome*. Ceylon. Malaya. Philippines. N. Australia. *Afr.* : Angola, Guinea Coast.

This fern is common in the Dehra Dún. The fronds from the same root twine together, and if there is a small tree within reach together twine round its trunk to a considerable height. I have measured a plant trailing on the ground, which was 12 ft. in length. The rhizome is small, erect or suberect : stipes approximate, wiry, covered at base with minute black-brown scales : naked above.

3. **L. japonicum**, Sw.; Syn. Fil. 439; C. R. 584; Bedd. H. B. 457.

KASHMIR: *fide* Clarke in 'Review'; Poonch Vy. 3000′, Winterbottom, Jhelum Vy. near Domel, "in great profusion," MacLeod 1891, Tawi Vy. 3500′, Gammie 1891.

PUNJAB: *Chamba*—Ravi Vy. 4000′, McDonell; *Kangra Vy. Dist.*, Mr. D. MacDougall, *fide* Trotter.

N.-W. P.: *D. D. Dist.*—Jaunsar, Tons Vy. 3000′, Gamble; The Dún—Vicary in Herb. Hort. Saharanpur; Duthie 1882; Johri, near Dehra, 2600′, Hope 1889, 1891; *T. Garh.* 3000′, Mackinnons 1879; Sahlra 7000′, Tons Vy. 4000′, Gamble; Ganges Vy. 4-5000′, several stations, Duthie 1881-83; *Kumaun*, near Banna 5500′, S. & W.; 2-5000′, many places; "19·7·49, Hydroglossum," Herb. Hort. Sahar.; Davidson, Duthie, Hope, Trotter, MacLeod.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán 2-7000′. S. Ind.—W. Mts. rare, *Beddome*. Ceylon. Java. Philippines. China—Horgkong. Japan. N. Australia.

Clarke says this plant differs very little, in his opinion, from *L. flexuosum*, and Beddome that it is probably only a form of *L. flexuosum*. Why not *vice versâ?* I see marked differences, and do not see the probability suggested. The rhizome is distinctly creeping, though perhaps slowly, and branching; I have not seen *L. pinnatifidum* with that habit.

> [ANGIOPTERIS *evecta*, Hoffm. In the Saharanpur Herbarium are two specimens of this, contributed by Dr. King, one of which is ticketed "Hindu Koh," and the other, from the Dalzel Herbarium, "Lahore"; but I think it best not to give this as a N.-W. Indian species. In the '*Synopsis*' is noted, under *Angiopteris*, *Psilodochea salicifolia*, Presl., as "an entirely obscure plant, supposed to have been gathered in Lahore, said to be like *Angiopteris*, but without an involucre." I do not understand Beddome's entry—"Throughout the Indian region up to 7000′ elevation." Clarke only says—"Round Bengal, alt. 0-7000′, from Nepál to Bhotan and Chittagong."]

1. **O. lusitanicum**, L.; Syn. Fil. 445. *O. vulgatum*, L., *var. Aitchisoni*, C. B. Clarke in 'Review' 586.

AFGHAN.: Kurram Dist, "on the shingle plains, at an altitude of 5000′; August", Dr. J. E. T. Aitchison, No. 454, 1880.

PUNJAB: *Rawalpindi* and Hurroo Bridge 2400′, Aitch. C. R., and in Herb. Hort. Sahar., 1882; Salt Range—Tilla Mt., and Rhotas, Aitch. 1872-74, in Herb. Hort. Sahar.

Mr. Clarke's description of his *O. vulgatum*, var. Aitchisoni, is:—"Rhizome elongate, bearing annually 4—10 fronds in succession, 2—2¼ in. l. by ⅔—¾ in. br., oblong, texture stout."

DISTRIB.—Europe: Guernsey: shores of the Mediterranean; S. France—Pau, *P. N. Fraser*.

Mr. Clarke remarks:—"There is no other *Ophisoglossum* in the Herbarium" (Kew?), "nor any picture much like this: the rhizome appears to bear a succession of fronds in one season: these are 1—2 fully developed, 1—2 young ones emergent, and several withered laminæ on the rhizome." The rhizome is "elongated" upwards, not horizontally. As I find this plant agrees with the figures given in Britten's 'European Ferns' for *O. lusitanicum*, I place it under that species provisionally, though I was at one time minded to make a new species of it—*O. Aitchisoni*. It appears to me quite unlike *O. vulgatum*.

Mr. Clarke remarks:—" A. Braun, in Seuber, Fl. Azorica 17, describes an *O. polyphyllum*; but this has venose fronds, the whole plant only 1—2 in. high, and comes from Terceira, and is probably not near *O. Aitchisoni*." A discussion regarding *O. lusitanicum*, L., and *O. polyphyllum*, A. Br., by H. C. Watson is to be found in "The Azores," by F. du Cane Godman, F.L.S., F.Z.S., &c., and in manuscript "Notes on the plants contained in the collection made by M. Drouet in the Azores in 1857," sent to H. C. Watson by Robert Shuttleworth, Ph. D., of 17th July 1871, which Mr. Baker has shown me, I find as follows:—" 89. Although no *Ophioglossum* is in Drouet's collection, I have abundant specimens of the so-called *O. lusitanicum* of the Azores. This has nothing really in common with the true *O. lusitanicum*. I consider it a distinct species from *O. vulgatum* (under two of the forms of which Milde quotes it) for it is apparently widely distributed—Silesia (Milde). I have it from Arabia and elsewhere; and I have received it, or a similar species (which for the present, on account of an apparent midrib—false, probably—I have called *O. Reverchoni*) from the neighbourhood of Briançon (Hautes Alpes) in good specimens, but as being very rare."

2. **O. vulgatum**, L.; Syn. Fil. 445; C. R. 568; Bedd. H. B. 464.

PUNJAB: *Chamba State*—Kantli, 12 miles from Dalhousie 6500′, McDonell 1882; *Simla Reg.*—Hattu Mt. 8-9000′, Dr. G. Watt 1885 (Blanford in List); Bagi (Hattu Mt. ?) 9400′, Bliss 1891-92.

N.-W. P.: *D. D. Dist.*—Jaunsar, Thadyar 7000′, Rogers 1891, Bodyar 8000 Gamble 1894, Kathián 7000′, Gamble 1895; Mussooree—'The Park,' above 6000′, Mackinnons 1885, Hope—seen July 1892—too late in the season—station shown to me by V. Mackinnon; in the Dún—Kalanga Hill, near Dehra, 3000′, Gamble 1894.

DISTRIB.—*N. Amer.*: Quebec and Ontario southward to Florida and California; Kentucky, Tenessee, Texas and Arizona to Alaska. *Europe*: Lapland, British Isles and almost all other countries to Caucasia. *Asia*: N. Ind. (Him.) Sikkim 2-4000′, Anderson, Clarke, Levinge; Bengal—Chutia Nagpur, on Para-náth Mt. 2500′, Clarke Nos. 33823 and 33826. Japan, Sandwich Islands, Australia, N. Zealand. *Afr.*: Azores, Abyssinia, Guinea Coast, Angola, St. Helena, Zambesi Land, Cape Colony, Mascaren Isles.

I cannot make out the difference between *O. vulgatum*, L., and *O. reticulatum*, L., unless it be that the net-work of veins is fine all over the frond in the latter named species, and in the former five only near the margins, the meshes in the centre being long and narrow. Anyhow, I can see no difference between the N.-W. Indian specimens and those I have gathered in Scotland, except that one of Gamble's plants from Jaunsar and another of his from Kalanga Hill in the Dún, both in my possession, have two fronds, one of them sterile. So also has a specimen collected by Dr. King, in the Teesta Valley, Sikkim, in 1876. Beddome, in Suppt. H. B., 1892, says he believes "all the Himalayan specimens are referable to *reticulatum ;* I can see no difference in the venation." Why, then, does he favour *O. reticulatum ?*

Genus 34. BOTRYCHIUM, *Sw.*

1. **B. lunaria**, Sw. ; Syn. Fil. 447 ; C. R. 587 ; Bedd. H. B. 469.

AFGHAN : Kurram Vy., Shend Toi "profuse", 9-10,000′, Aitch. 1879.

KASHMIR : West of Gulmarg, 9000′, Aitch.

PUNJAB : *Simla Reg.*—Hattu Mt. 8-9000′, Kamalhori Mt. 9-10,000′, Dr. G. Watt 1885, *fide* Blanford.

N.-W. P. : *T. Garhwal*—Nag Tiba Mt. 9-10,000′, W. Gollan 1881 ; Damda Vy. 10-11,000′, Duthie 1883 ; *Kumaun* above Tola 12,000′, S. & W. ; Garbyang 12,000′, Duthie. Also—N.-W. India, Jameson, *fide* Clarke in 'Review.'

DISTRIB.—*N. Amer.* : Greenland, Newfoundland, Canada, British Columbia ; *U. S.* : New York, Lake Superior, Colorado. *S. Amer.*—Patagonia. *Europe* : Iceland, Arctic Russia, Livonia, Lithuania, and Caucasia ; British Isles ; Spain, Italy, Switzerland and Mediterranean Isles. *Asia* : W. Thibet, Falconer : Karakoran Range, 12,500′, *Clarke* ; N. Ind. (Him.) Sikkim—Lachen 10-13,000′, Hk. fil. Kamschatka, Japan. Australasia—S. Australia, Tasmania, N. Zealand.

2. **B. ternatum** (Thunb.) *Sw.* ; Syn. Fil. 448 ; Bedd. H. B. 110.

PUNJAB : *Chamba*—McDonell ; *Simla Reg.*—Simla, "a little below 7000′," Blanford ; Summer Hill, Collett, Chadwick Falls 6000′, Bliss, "The Waterfalls," Bliss ; Mashobra 75-8000′, Bliss, Watt.

N.-W. P. : *D. D. Dist.*—Jaunsar, Bodyar, Mrs. Sladen 1880 ; Mussooree, 10-7-45, in Herb. Hort. Sahar., under *B. daucifolium* ; 'The Park', 6300′, Mackinnons 1885 ; *Kumaun*—Naini Tál, Levinge : *fide* Bedd. in Suppt. H. B., Bhim Tal, W. Ainslie, in Herb. Levinge.

DISTRIB.—*N. Amer.* : Nootka and Hudson's Bay Territory, Canada ; *U. S.* : New England, westward to California, Washington, and southward to Florida. *S. Amer.* : New Grenada. *Europe* : Lapland, Spain (Pyrenees), Hungary. *Asia* : Siberia, Kamschatka, Japan ; N. Ind. (Him.) Nepal, *Wallich* No. 49, Sikkim—*Clarke*, *Levinge* ; *Centr. Ind.* : Mt. Abu, *Sir M. Grant Duff*. *Australasia*—Tasmania, N. Zealand.

Indian specimens of this form used always to be ticketed *B. daucifolium*, Wall. But I saw in Mr. Gamble's collection a specimen of Mr. Clarke's, got in Assam in 1886, No. 45827, named *B. daucifolium*, which seemed to me to be typical, and quite different from those others. About the same time Mr. Trotter told me that Mr. Bliss thought the Simla fern was not *daucifolium*, and on hearing that I also had doubted this, Mr. Bliss wrote—"I am very pleased to find that, at last, some one besides myself has discovered that our Mashobra (Simla) *Botrychium* is not *B. daucifolium.*"

[Beddome, in his Handbook, gives *B. daucifolium*, Wall., as found "throughout the Indian region, up to 8000′ elevation;" but the only specimen in the Kew Herbarium from the westward of Nepál so named is one marked Kumaun, R. Bl. 49, "*an mera varietas*, Wall. 48 ?" But No. 48 of Walliche's catalogue is *B. lanuginosum*, Wall.

The other habitats of *B. daucifolium*, to which the specimens in the Kew Herbarium are referred, are Nepál, Winterbottom; Sikkim; Bhotán *Griffith*; Nilgiris, *Beddome* and *Clarke*; Anamalais, *Beddome*. Ceylon, *Gardner*. China—Yunnan, *Henry*. Japan. Samoa.]

McDonell's specimen of *ternatum* from Chamba is curious; it has two sterile segments at the base,—the fertile branch starting 1½ in. up. A Mussooree specimen I have from the Messrs. Mackinnon, shows the sterile and fertile branches on segments splitting from a common stipes at barely half an inch from the root stock,—the sterile one 7 in. l. by 7¾ in. broad, as mounted. The fertile branch has a stipes 10½ in. l., $\frac{5}{12}$—$\frac{7}{16}$ inch broad, as pressed; frond over 6 in. l. tripinnate. Mr. Ainslie's specimen from Kumaun, in the Levinge collection in Dublin, I noted as being very lax in habit: sterile branch 13½ in. l. from the point of separation: fertile branch 24 in. l., much branching. In the same collection I noted a remarkable specimen collected by Mr. Levinge in Darjiling, alt. 7160′, 12-10-1882, of which the fertile branch starts at 3 inches from the rhizome: the sterile spike (or the frond) then curves to the right (as mounted), and ¾ in. higher up throws off to the left a fertile branch with a thick stipes, which 1½ inches higher splits into two fertile, branching, segments of equal length. I believe Professor L. M. Underwood says that what I call *B. ternatum* is *B. obliquum*, Muhl.

3. **B. virginianum,** Sw.; Syn. Fil. 448; C. R. 588, including β. *lanuginosum*, Wall.; Bedd. H. B. 471, including *B. lanuginosum*, Wall.

PUNJAB: *Hazára Dist.*—Kagán Vy. 8000′, Inayat, collector from Hort. Sahar. No. 20388 (Herb. Number); *Chamba State*—McDonell.

N.-W. P.: *T. Garh.*, Datuni 7000′, Gamble 1893, No. 24348; Muráli 8000′, Gamble 1894, 24886; Duthie 1898.

DISTRIB.—*N. Amer.*: New Brunswick to Florida, and westward to Arizona and the Pacific Coast, *fide* Underwood. *S. Amer.* Ecuador and Brazil,—*fide* '*Synopsis*'. *Europe*: from Norway to Austria. *Asia*: N. Ind. (Him.) Sikkim—Rungbee, King 1878; marked "abnormal form."

I give this species as new to India, because I have no distinct recollection of King's Sikkim specimen, noted above; and, besides, that specimen has not been recorded. While I was at the Royal Herbarium, Kew, in 1888 or 1889, along with Mr. McDonell, I detected the Chamba specimen in his possession; and since then a few other specimens have turned up. Instead of making this a variety of the common Indian fern, *B. lanuginosum*, Wall., I bow to authority, and give it as *B. virginianum*, Sw., because the fertile segment of the frond separates just below the base of the sterile part, and the cutting is sharper than in *B. lanuginosum*, and the texture is not woolly. It is one of the rarest of Indian ferns.

Now, in finally revising this article, and having had the advantage of studying well authenticated specimens of the American plant, I am all the more satisfied that it is quite distinct from Wallich's *B. lanuginosum*; but I am not so sure as I was that the above noted Indian specimens are the same as the American plant. More material is desirable.

4. **B lanuginosum**, Wall. Cat. 48. *B. virginianum*, Sw., β., *B. lanuginosum*, Wall. Syn. Fil. 448; *B. virginianum*, Sw., C. R. 588 (*B. lanuginosum*, Wall., given as a synonym.) *B. virginianum*, L. (under *Osmunda*), *var. B. lanuginosum*, (sp.), Wall. Cat. 48, Bedd. H. B. 471.

PUNJAB: *Chamba State*—McDonell, in List; *Simla Reg.*—Simla: not uncommon, Hope, Blanford, Trotter, Bliss.

N.-W. P.: *D. D. Dist.*, Mussooree, in various places, 45-7000′, Duthie, Mackinnons, Hope, A. Campbell; *T. Garh.*—Jumna Vy. 6-7000′, Duthie near Sainjni, 5000′, Gamble 1898; *Kumaun*: Wallich; Gajur Pass, Davidson; Naini Tal 6000′, Hope 1861; Almora 5-5500′, Madden, S. & W., 1848, Hope 1861; between Dandiháth and Karéla 5-6000′, Duthie 1884; 6-8000′, "common", MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepal, *Wallich*; Sikkim and Bhotán common, *Clarke*; Assam—Khásia Dist., 4-6000, very common, *Clarke*; Manipur 5500′. S. Ind.—at the higher elevations on the W. Mts. Ceylon—above Newera Elya, China—Yunnan and Hupeh *Henry*; Yunnan *Hancock*.

The distinctions between *B. virginianum* and *B. lanuginosum* are thus stated by Beddome:—"In the typical American plant the fertile branch arises from the base of the sterile portion, and the latter is quite glabrous: in the Indian plant the fertile branch always springs from well above the base, and the sterile portion is more or less hairy." These two distinctions being, with rare exceptions, coincident, are corroborative evidence of permanent and, I should say, specific differences. I see a few soft hairs on some specimens of *B. virginianum*, but nothing amounting to wooliness.

Clarke refers to Milde's monogram on *Botrychium*, and to his Fil. Europe, 191-209, in which that author divides the genus into two main sections, *viz.*, (1) Cells of the epidermis straight: (2) Cells of the epidermis flexuose; secondary pinnæ of the lowest pair of pinnæ anadromous; and he (Clarke) says that the second section contains *B. virginianum* (the American type plant only); the first section comprising, among other species, *B. lanuginosum*, Wall., which Milde and Prantl both hold to be a good species, one character being the catadromous secondary pinnæ at base of a sterile segment. Clarke finds that all the Indian material he has seen seems one species, with straight epidermis cells; but he can make very little of the ana-cata-dromous distinction. Milde finds both sets of plants in the Himalaya, and reckons them very distinct species. After examining all the specimens of *B. lanuginosum* in Gamble's and my collections, I find that a decided majority is catadromous, but one specimen is anadromous on one side, and has pinnules exactly opposite each other on the other side. I think with Clarke that this distinction may be disregarded,—the more so that it is not needed.

B. lanuginosum varies very much in size, cutting, and habit. I have a specimen from a little below Naini Tál with stipes 4 in. and frond 5 in. l. by 6 in. br., and another from the hill north of Almora, grown in open pasture—mounted on two sheets, though minus the upper third—the lower pinnæ of which are 10—11 in. l. by 6—9 in. br., as mounted. The next higher pair of pinnæ are 7¾ and 9 in. l. by 3½ in. br. The fertile spike is about 8 in. l. with lowest pinnæ 3½ in. l., tripinnate like the rest of the frond. A large frond, also from Kumaun, *Davidson*, is much more compound, and may almost be said to be quinquepinnate. I look upon the sterile part of the plant, taken together with the stipes, as the frond, and would not talk of it as a segment. It is a regularly pinnate frond, and the fertile spike is an extra branch or pinna, which does not interfere with the symmetry of the frond in other respects. I am confirmed in this view of the structure of the plant by finding in Gamble's collection a specimen from Ootacamund, in the Nilgiris, which, besides the usual fertile pinna (in this case as in all Mr. Gamble's Nilgiri specimens, taking off above the second lowest pair of the frond), has a small fertile pinnule on one of the lower pair of pinnæ taking off above the lowest pair of secondary pinnæ or pinnules. Another curious specimen in Gamble's collection from Mysore 5000′, "coll. W. A. Talbot," No. 3087, 1893, has two fronds springing together from the same root, about equal in size, and perfectly normal, each with its fertile spike. My large specimen from near Almora has some sori on the sterile pinnæ, one cluster of six on the fourth pinna from the base, and several others here and there. I think a similar case was mentioned lately in the Journal of Botany with regard to another species of *Botrychium*. *B. lanuginosum* has a thick rhizome and thick, fleshy roots, and is a terrestrial fern; but, like various other plants of the Himalayan forests, it is sometimes found growing in the clefts of branches of trees, sometimes high up. I have two specimens from Assam which are quite glabrous.

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SNAKE-BITES AND POISONOUS FISHES.

By P. W. Bassett-Smith, M.R.C.S., R.N.

(*Re-printed from Vol. XI. of the* Encyclopædia Medica.)

From very early times there has been a common belief that certain people had a peculiar power of freely handling venomous snakes, and that a measure of resistance to the poison was acquired. Some of these "snake men" are not only described in old records as being immune to the poison, but also as having a remarkable influence over the snakes themselves; it was popularly supposed that snake blood flowed in their veins.

In present times it is well-known that some men exhibiting snakes in India frequently rub in small quantities of the venom on the back of one hand with the other, a small part being probably absorbed. In South Africa the Hottentots are said to eat the heads of poison snakes when killed.

Serpents were very generally worshipped by ancient man; their great beauty, grace of movement, and frightful power of causing rapid death by injecting venom, or by crushing, appealed strongly to the superstitions of the people, who either associated them with death or wisdom.

This serpent worship was almost universal, and is nowhere more prevalent than in India, where even in the present day the cobra is held in very great veneration, and it is never willingly killed by the Hindoos. In pre-Buddhist times, that is, about 600 B.C., the gods were represented with a canopy of five or seven cobras over them (Naja figures), and in the old cave temples very beautiful relics still remain showing these. In Southern India a single cobra is frequently represented alone. It is also one of the symbols of Shiva now.

In Egypt the old papyrus records show that snakes were divided into two classes; one, generally the cobra, being associated with divinity and symbolising wisdom; the second representing the malign influences and death, depicted as the serpent "Apep," the emblem of darkness, and the enemy of "Ra" the sun.

In China these beliefs take a more practical form, the concretions, etc., of snakes finding a prominent place as therapeutic remedies. Traditions of the same kind have been passed down from mediæval days to witches, etc.,—*vide* "*Macbeth.*"

Many curious powers are attributed to snakes beyond the mesmeric influence they exert over their victims before springing upon them. Thus a "krait" or species of *Bungarus* found in Scinde is called by the natives there "pyan" or drinker. This snake is said to suck in a man's breath when he sleeps, the result being that he dies at sunrise, with a swollen face, but no mark of a bite on him. No one will sleep on the ground for fear of the "pyan" in this district. The natives, however, admit that it can bite, but rarely does.

Venomous snakes are divided into two main classes—(1) Colubrine, (2) Viperine.

The Colubrine again into (1) Elapidæ, or land snakes.
(2) Hydrophidæ, or sea snakes.

The Elapidæ include—

(1) *Naja*, or Cobras found in India, China and N. Africa.
(2) *Ophiophagus*, or Hamadryads, found in India and East Indies.
(3) *Bungarus*, or "Krait," of India.
(4) *Hoplocephalus*, or Tiger snakes, etc., found in Australia.
(5) *Pseudechis*, or Black snake, found in Australia.
(6) *Acanthophis*, or "Death adder," found in S. Africa and Australia.
(7) *Elaps*, or "Coral snake," found in West Indies and Brazil.

The Hydrophidæ include—(1) *Hydrophis*, (2) *Enhydrina*, (3) *Pelamis*, (4) *Platurus*, (5) *Aipysurus*.

The poisonous Viperine snakes are divided into—

(1) Viperidæ, or true vipers.
(2) Crotalidæ, or pit vipers.

The most important of the former are—

(1) *Daboia*, or "Tic-polonga," "Russel's viper," of India and Ceylon.
(2) *Echis*, or "Fursa," of Northern India.
(3) *Cerastes*, or "Horned viper," of Egypt.
(4) *Pelias*, or "Common adder," of Europe.

Of the latter—

(1) *Crotalus*, or "Rattlesnake," of America.
(2) *Bothrops*, or "Fer de Lance," of W. Indies.
(3) *Halys*, of India.

GEOGRAPHICAL DISTRIBUTION.—Poisonous snakes are found in all tropical areas, except certain oceanic islands, and in most temperate ones, New Zealand being a marked exception.

Each region has, however, distinctive characters.

In Asia and Africa the cobras, hamadryads, kraits, and true vipers are most abundant.

In America the Crotalidæ.

In Australia the pit vipers are not at all represented. Krafft states that twenty-one innocuous and forty-two venomous snakes occur there, but of the latter only five are dangerous to man; these include *Hoplocephalus*, *Pseudechis*, and *Acanthophis*.

In South Africa, chiefly the Acanthophis, or Death adder.

In the West Indies, *Elaps* and *Bothrops*.

The *Mortality* from snake-bite in India is very high, being even now put down as about 20,000 annually, equal to about 1 to 10,000 of the population.

In Australia the death-rate proportionately is considerably less—probably, as Martin states, due to the people having a much better knowledge of what to do.

The most deadly snakes in India, according to Fayrer, being in order of severity of action—(1) Cobra, (2) Kraits, (3) Daboia, (4) Echis.

In Australia *Hoplocephalus curtus*, *H. superbus*, and *Pseudechis* are the worst. The sea snakes rarely attack man, though so common in Australia and waters of the Far East.

Anatomical Characters.—The " true vipers " are distinguished by their triangular-shaped head and constricted neck ; the scales on the head are generally small, the loreals (scales between the nasal and anterior ocular) are almost always wanting. The pupil is vertical ; the fangs are tubular, large ; reserve teeth being present, but no others are found on the short maxillary bones ; the tail is rapidly attenuated.

The " pit vipers " have triangular heads, but with large scutes on the top ; otherwise as in the true vipers, the poison fangs are very large, the maxillary bones are small and very movable, and the tail ends in a rattle or hard spine.

The poisonous *Colubrine* have smaller heads of regular shape ; the scutes on the top are generally well-marked and regular ; the " loreals " are usually absent ; the maxillary bones are longer, less movable, and the fangs smaller than in the vipers, and they are grooved along the anterior border and not tubular. The pupil of the eye is generally round, and the tail gradually tapers to a point.

The *Hydrophidæ*, or sea snakes, have small heads, with the nostrils on the upper surface. The anterior frontal scutes and loreals are absent, the pupils are round, the ventral shields are usually absent, and the tail is flattened from side to side, the tongue is short, and the poison fangs are small and grooved.

The great distinction between non-venomous and poisonous snakes is that the former possess two complete rows of small ungrooved teeth on either side of the upper jaw, the outer row, twenty to twenty-four in number, being attached to the maxillary bones, the inner to the palatine ; when they bite, they leave characteristic marks.

In poisonous snakes the outer row is represented by one or more tubular or grooved fangs, firmly ankylosed to the maxillary bone, which is freely movable; this mobility allows the erection and depression of the fangs. The anterior is always the largest, the others, if present, being reserve teeth. When these snakes bite, they leave usually two punctures only.

The *Venom* is secreted by a compound racemose gland, which Gunther describes as being homologous with the parotid glands of mammals, having large alveoli which act as receptacles for the fluid ; these glands are placed behind the orbit above the angle of the mouth ; they are invested with a dense fibrous sheath, being also covered by the masseter muscles. The excretory duct passes forwards, opening into the base of the sheath of mucous membrane covering the fang, being here bent at an acute angle, so as to face the front border of the tooth, thus allowing the fluid to flow freely down the tube or groove as the case may be. When the snake opens its mouth to bite, the muscles act on the maxillary bones and erect the fangs ; as the jaw closes on the part bitten, the masseter and pterygoids compress the poison glands so that the venom is forced down the duct into the tooth and injected into the wound. The firmer the hold obtained, the greater the quantity of venom injected, and the greater the danger.

Non-poisonous snakes also have rudiments of this gland, which secretes a poison not in sufficient quantities to be harmful, but sufficient to render them resistant to the toxic effects of other poisonous snakes when bitten. (Fraser.)

In 1896 Prof. Fraser asserted that the serum of poisonous snakes possesses antitoxic powers, and presumes that this was acquired by the snake swallowing its own venom. Cunningham later disproved this, showing that the natural immunity of the snake is quite distinct from the artificial immunity, which is established in other animals as the result of continued cumulative treatment by cobra venom, and that it is unconnected with any material of the nature of an antitoxin. He found that cobra serum had *no* antidotal effect on Daboia venom ; he does not therefore believe that the immunity of snakes is due to the swallowing of their own venom.

The fact, however, remains, that most reptiles and amphibians possess a high degree of resistance as a natural property, quite independent of any process of self-protection. One of Cunningham's snakes readily resisted an amount of cobra venom enough to kill one hundred fowls, yet its serum had no protective power ; its blood indeed was highly toxic for one week after, enough to rapidly kill a fowl when injected.

The immunity of snakes to venom of other and the same species is not absolute though general, for I have seen a *Daboia russelli* in captivity attack a second in the same cage, which was found dead soon after. Also any one who has seen a fight between a hamadryad and a rat snake " Dhamin " of equal or larger size will remember the gradual poisoning of the latter, which nevertheless meanwhile inflicts much local injury on the less powerfully toothed but successful adversary. A species of *Bungarus* or " krait " of Scinde will kill and swallow the very venomous " fursa " or *Echis carinata.* Cunningham further believes that the degrees of susceptibility to some extent run parallel with the respiratory acquirements, the slow-breathing, hybernating reptiles and lizards having the greatest resisting power. The mongoose is remarkably resistant to cobra poison, requiring from 10 to 25 times as much venom per kilo as a rabbit to produce lethal effects. Elliot believes that the success of this animal fighting cobras depends on (1) its great agility, (2) its habit of " setting up " its fur, thus deluding the snake as to the vulnerable part. Its immunity is due to the habit it has of seizing the snake by the head, and often by so doing incising the gland with its sharp teeth, causing the venom to escape and be swallowed by the mongoose ; this would also reduce the possible amount to be injected down the fang. Then there is the inoculation of minute quantities of venom from repeated, but ineffectual, scratch-bites. In these ways a partial immunity, which is hereditary, is established, becoming lost in time if the animals be removed to countries where cobras do not exist.

Other creatures are slightly immune, as pigs and guinea-fowl ; the latter, according to Calmette, being to a slight degree protected by having large air sacs. It has lately been shown by Calmette and others that the resisting power to venom becomes greater the larger the animal ; thus it takes a much smaller dose of venom proportionally, volume for volume, to kill a rabbit than a dog, man being even more resisting.

Venom is obtained pure from the different poisonous snakes by either making them discharge the fluid direct into a watch-glass, this being assisted out by gentle pressure applied to the poison glands, the snake being held in the hand with its head directed away from the operator as described by Calmette ; or the venom may be obtained by causing the snake to bite at a watch-glass covered with gutta-percha, the fluid collecting on the under side. The venom should be taken from a fasting snake every two weeks or so. From a good-sized cobra about 2-3 c.cm. is the average quantity obtained by Calmette, after which he generally artificially feeds the snake.

The venom thus collected has much the same appearance in all snakes—a limpid fluid of yellowish colour ; from the cobra it is a faint yellow, that of the hamadryad being a golden yellow ; it has a slightly acid reaction and an average specific gravity of 10·50 ; a bitter taste is said to be present in the venom of the cobra, but not in that of the Daboia. When the venom is placed under the microscope, nothing should be seen except a few epithelial cells and perhaps some contaminating bacteria. When kept moist, it gradually becomes more acid and decomposes, forming a coagulum, the fluid remaining poisonous.

Venom, when dried at a moderate temperature, 20° C., forms reddish-yellow or brownish-yellow crystalline scales, or it becomes agglutinated into little masses like gum-arabic. When thus dried and kept in the dark, it retains its toxic powers indefinitely. The dried residue equals in weight about 20-30 per cent. that of the moist venom. If the venom be heated at once after collecting to a temperature of 100° C., its toxic effect becomes impaired, and also if it be exposed to light.

The poisonous properties of *all venoms* depend upon the presence of at least two distinct toxic proteids. These proteids are similar to other albumoses produced from albumens, which may have been obtained by

(1) Boiling under high pressure.

(2) Gastric and pancreatic digestion through the agency of a ferment.

(3) The direct vital activity of cells.

(4) By certain micro-organisms, as *Bacillus diphtherix, B. tuberculosis, and B. anthracis;* by means of a ferment in the case of diphtheria, but by the direct action of the other two.

The proteids of venom are elaborated by a process of dehydration of albumen, without the action of any ferment by the epithelial cells of the poison glands, the ultimate product stopping short at the albumenose stage, not proceeding to the production of peptones as occurs in all the before-mentioned, except the toxin produced by diphtheria. (Sidney Martin.) In all cases, however, these albumoses, though differing greatly in intensity of action, yet when gaining access to the blood produce certain toxic effects; hence the antitoxic principle which now underlies the treatment of snake-bite, etc. The poisonous properties of peptone are becoming much more recognized through the work of Prof. Wright and others; it is an important fact to deal with in the preparation of antitoxic and prophylactic serums.

It has been shown by Martin and Gavan Smith that when dried venom is heated, it separates out into an albumen coagulated by heat, 70°-80° C., and a filtrate non-coagulable at any temperature, its action being, however, destroyed by boiling.

It has been further shown by Calmette that the albumen thus coagulated out has little toxic power, but that the filtrate, when dialysed out in a current of sterile water for twenty-four hours, gives a solution which, on being dried *in vacuo*, forms a brownish amorphous powder forty times more toxic than ordinary venom.

The amount of the coagulable and non-coagulable proteids varies in amount and proportion in different classes of snakes; thus in the Colubrine there is a large amount of non-coagulable poison, in the Viperine there is a very considerable quantity of the coagulable; on this difference depends to a large extent the variation of the symptoms produced by individual snakes. This is nevertheless only one of degree, as the *toxic effects of the non-coagulable poison are very much the same in all*, acting principally on the nerve centres, producing death by paralysing the respiratory centre in the medulla. The coagulable proteid acts chiefly on the blood-vessels and heart, being a powerful local irritant.

Cobra poison, which, as before stated, is rich in the non-coagulable proteid, kills by producing asphyxia, the heart beating after respiration has stopped; hence the use of artificial respiration in the treatment.

Rattlesnake venom is rich in the coagulable proteid, producing disastrous effects on the blood-vessels and heart.

Australian snakes show a good deal of both, and have an intermediate action.

Sir Joseph Fayrer found that cobra venom killed without destroying the coagulability of the blood, whilst Daboia (viper) poison caused complete and permanent fluidity, the blood of the animals so killed being excessively toxic.

Cobra poison produces little change in the pupil, Daboia widely dilates; salivation is a constant symptom of the former, rare in the latter.

When experimenting with venoms, Calmette and others at Lille use only the non-coagulable proteid, by which means they get rid of the intense local reaction of the second proteid, and as the *chief* toxic properties are in the former, the physiological effects of the venom are better thus watched. He also at once mixes up the venoms of all his snakes, from the sum total of which he obtains his dried toxin for experimental purposes.

It has been found that the non-coagulable filtrate of all venomous snakes, whether Viperine or Colubrine, has, when injected, the same characters and gives rise to the same symptoms.

The rapidity of the onset and the severity of the case depends on whether the virus is injected direct into a vein or into the subcutaneous tissue. It is rarely absorbed by healthy mucous membranes, but Fayrer is strongly adverse to the practice of sucking cobra bites. Also recently ejected venom acts as a powerful local irritant when applied to the conjunctiva, and may be absorbed.

The question of absorption and the neutralisation of venom by the various secretions of the body is of great interest, having been specially studied by Prof. Fraser and Capt. Elliot, I.M.S.

Martin states that gastric digestion does not affect cobra or Pseudechis venom. Mitchell says it does that of the rattlesnake. Fraser found that snake venom introduced by the mouth was not followed by any bad results. This was either due to non-absorption, or the chemical changes produced there by the gastric secretions. The latter was disproved by finding that after removal it still retained poisonous properties when injected into the blood. He next found that by mixing bile with the venom it was rendered innocuous.

Elliot has since, by experiments on dogs, proved that after diverting the bile completely, venom given by the mouth was still innocuous, but that if introduced into the small gut, it was rapidly absorbed through an unbroken epithelial surface, causing death. He concludes

(1) That cobra poison can be absorbed through the mucous membrane of the small gut, though not so readily as when injected in the subcutaneous tissues.

(2) That some change is induced in the swallowed cobra venom before it reaches a rapidly absorbing surface.

(3) That though bile is powerfully antidotal, as proved by Fraser, yet it is not the only protective agent.

(4) That tripsin is very powerful in reducing the lethal properties of cobra venom. Martin states that *all* venoms are destroyed by pancreatic digestion.

The result of all venoms is at first to produce a rapid fall in the blood pressure, during which the animal may die ; if not, the blood pressure again rises, going above normal, as occurs after the injection of toxic peptones. In cobra poisoning the blood pressure may remain high until the time of death, even during the asphyxial period ; if artificial respiration is then efficiently carried out, convulsions are prevented and life may be saved.

Lauder Brunton and Fayrer concluded that, besides paralysing the reflex activity of the cord, the poison acts on the nerve endings in the muscles like " curare." In the poisoning by vipers and Australian snakes, the dyspnœa and fall of the blood pressure occur together ; but though producing the same paralysis of the reflexes of the cord, they *do not* especially select the respiratory centre. In these cases, therefore, artificial respiration is usually of little avail.

The action of venom on the blood has been shown by Martin and Halford to cause a rapid destruction of the red corpuscles, the leucocytes being relatively increased in numbers, these very quickly degenerating, their vital activity being destroyed. Martin placed two small pieces of sponge antiseptically in the abdominal wall of a guinea-pig, one having been soaked in a neutral saline solution containing 1 per cent. of venom, the other in the solution free from venom ; œdema occurred around the sponge containing the venom. After five hours the animal was killed. Both sponges were withdrawn, hardened, and sections made from them. In the first, healthy leucocytes were only found at the periphery, broken down ones filling the interior ; in the second, the whole was permeated with healthy phagocytes.

Calmette, from his experiments, finds that the venom does not act directly on the nerve-cells of the brain, but on the leucocytes, and that it is carried by them to the bulbo-medullary centre.

The rapidity with which venom acts depends on

(1) The quantity injected.

(2) The rapidity of absorption.

(3) The condition of the snake at the time of the bite.

(4) The susceptibility of the animal ; the personal factor, as pointed out by Elliot, being very important.

A minimum lethal dose always takes a considerable time to produce its results, and, as the amount injected is generally small, there is frequently time to apply remedial measures.

Calmette gives the toxicity of venoms according to their virulence, based on the number of grammes of an animal killed by one gramme of poison, as

Cobra,	4,000,000.
Hoplocephalus,	3,450,000 (4,000,000 Martin).
Pseudechis,	800,000 (2,000,000 ,,).
Common Viper,	280,000.

Sir J. Fayrer believes that a full dose of venom from a cobra, hamadryad, krait, or Daboia is necessarily fatal. It is only in cases where an amount little above the minimum lethal dose has been injected that remedial measures are of any use.

The effects of Heat and Chemical Agents.—A temperature of 100° C., if prolonged, will modify or destroy any snake venom, even after the removal of the coagulable proteid.

A 10 per cent. sol. of caustic potash or soda, after being in contact five or ten minutes, diminishes the poisonous properties of the virus.

A 1 per cent. sol. of pot. permang. destroys one part of venom when in contact, but its action is unreliable.

Hypochlorite of lime, 1 in 60 of water freshly made up, destroys the venoms completely, as also does 1 per cent. of chloride of gold. The latter two are the only ones recommended by Calmette, and are generally accepted now as being the best.

SYMPTOMS.—These are very varied according to the character of the snake and the amount of venom introduced, but depending greatly upon the presence or absence of the coagulable proteid.

Cobra.—If the amount injected be very large, death may follow very rapidly as if from shock—due to paralysis of the cardiac ganglia. When introduced in smaller quantity, and slowly absorbed, it produces some local redness and œdema, with progressive weakness and general paralysis, but showing a great preference for certain centres, particularly those governing the tongue, lips, and larynx, causing inability to swallow and profuse salivation ; respiration is rapidly extinguished with or without convulsions, and finally the heart stops, the pupil is contracted but reacts to light, the urine is never albuminous. If the symptoms pass off, complete recovery is rapid. When the poison is injected in a maximum lethal dose, stimulation of the centre produces violent convulsions, especially respiratory spasms, followed by general paralysis and rapid death.

European Viper.—Very quickly after the bite there will be local pain and swelling of the part, with general prostration, feeble pulse, perhaps passing into a condition of semi-coma or delirium, with slight convulsions. Recovery is generally rapid, though local suppurations not infrequently follow.

Daboia and Indian Vipers.—In these there is marked local inflammation at the seat of the bite, with swelling of the limb, great pain and hæmorrhages. Violent convulsions soon set in, but not necessarily followed by general paralysis and death. The paralysis does not especially select out the respiratory organs as in the case of cobra poisoning. The breathing has a peculiar irregular character, being at first quickened, then slowed. Hæmorrhages from the mucous membrane are common, hæmaturia and albuminuria being almost always present. The pupils are generally dilated and insensitive to light.

Rattlesnake.—The symptoms following the bite of one of these snakes are much like those produced after a bite from the Indian vipers, except that the local symptoms are more marked, general symptoms of blood poisoning being after a short time evident. Recovery from an almost hopeless condition is sometimes extraordinarily rapid.

Australian Snakes.—In these, according to Martin, local pain and swelling of the part bitten is not generally severe. The constitutional symptoms come on from a quarter to half an hour after the bite, with faintness, drowsiness, and prostration, the pulse gets thready, respiration becomes slow, hæmorrhages and albuminuria are generally present, the comatose very condition gets deeper and deeper, respiration stopping, then the heart.

Sea Snakes.—Although all these are poisonous, they rarely attack man. I have seen scores taken by careless sailors on the north-west coast of Australia, etc., without any bad results. Several instances of fatal bites have been recorded, one having caused death in $1\frac{1}{4}$ hour.

The most fatal period after all bites appears to be between two and three hours ; more than 25 per cent. die between one and three hours.

Treatment.—When a person has been bitten by any snake supposed to be venomous, the first and very important measure is to prevent the entrance of the virus into the general circulation. As the part bitten is generally one of the extremities, this may often be done by applying a tight ligature at once between the part bitten and the trunk ; the second point is to remove or counteract the virus as soon as possible, suck the wound to extract the poison, cut the part out or cauterise freely, then wash the wound well with hypochlorite of lime=800 parts of chlorine to one of lime, or inject 8-10 cm. of the same in the track of the bite ; this destroys the venom *in situ,* neutralising that not yet absorbed, or a solution of chloride of gold would act equally as well.

Inject 10 to 20 c.c. of antivenine if obtainable into the subcutaneous tissue of the flank, or if general infection is marked give it intravenously ; after this has been done the ligature may be removed. One should also promote warmth, stimulate the circulation, and carry on artificial respiration if necessary. If no antivenine is to be had, give stimulants freely.

Half the number of fatal cases are stated to die from fear, not having the heart at the time to apply any remedial measures (Krefft).

Serum Therapy.

The analogy between certain toxins produced by pathogenic micro-organisms, as diphtheria, tetanus, etc., and the products of snake venom, together with the effects that they produce on most mammals, led to the belief that some antitoxin might be prepared for the latter, which would give protection against the virus. In spite of the opinion of Sir J. Fayrer and others that any idea of finding a physiological antidote was utopian, it has to a great extent been actually accomplished : the preparation and dispersion of a most valuable antitoxin is now being carried on in large quantities by Professor Calmette of Lille and his assistants. There is also to be a special laboratory, under the care of Major Semple, to supply this antivenine on the spot for the use of India.[1]

History.—Sewall in 1886 experimented on pigeons. By very gradual and repeated injections of rattlesnake poison, he produced in them very marked resisting powers to that poison.

Cunningham, by experiments at Calcutta, found that though a fowl may be immunised against cobra bite by repeated injections of the virus, yet that it was not then protected from Daboia poison and *vice versâ,* in contradistinction to the statements of Calmette and Fraser, that an animal immunised to cobra poison was also immune from *all* other snake venoms—a doctrine quite contrary to Behring's law, " that the action of an immunising serum is specific."

Phisatrix, Bertrand, and Calmette advanced knowledge a step further. Experimenting with rabbits and the venom of vipers, cobras, etc., they found that not only were they able to immunise the animal itself, but they also found that the serum of these animals had distinct antitoxic powers if administered within an hour of the injection of the venom, causing what would have been a lethal dose to be less so or non-effective.

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[1] This laboratory is now in active existence.

Professor Fraser in 1895 administered large doses of cobra venom into the stomach of a cat, producing no poisonous effects on it; but the cat was found to be immune to the poison when given hypodermically, and that its blood serum had antitoxic properties. He also found that its kittens acquired protection through the milk supplied by the mother.

Snake men are believed to acquire a certain amount of immunity by the repeated inunctions of small doses of venom on the hand, or, in Africa, by eating the head of the snake—at least that is a common opinion held in South Africa. Captain Elliot, I.M.S., from his recent observations in India brings forward evidence to favour the following conclusions:—

(1) That "snake men" in India, as a rule, have no knowledge of acquiring any immunity, but trust to their own intimate familiarity with the habits of the snakes, or to the previous mutilation of them, by removing their fangs, or sometimes by producing an internal fistula from the poison gland into the mouth.

(2) That a *few* do practice swallowing venom or the inunction of venom into the limbs.

(3) That they confine their work entirely to the cobra, the Daboia being very irritable, uncertain, and not at all amenable to their charming.

Calmette has shown that the antitoxic properties present in the serum of animals immunised against venom are *not* due to the direct action of the antitoxin on the virus, but that it is exerted through the tissue elements of the animal. He next proved that by mixing the venoms of various snakes, including Naja Daboia and Hoplocephalus, etc., and removing the coagulable irritative proteid, using only the active toxin of the dialised non-coagulable form, he was able to produce an antitoxic serum (from horses) which immunised animals and man from lethal doses of *any* venom, although each snake venom has *per se* well-marked toxic peculiarities producing several and various local phenomena.

In 1898 Major Semple, R.A.M.C., Captain Lyons, I.M.S., and Staff-Surgeon Andrews, R.N., under the supervision of Professor Calmette by a very complete set of experiments demonstrated that antivenomous serum could be prepared from horses which had a very high antitoxic power; that its preservative action shows itself almost instantaneously when injected intravenously, but if injected subcutaneously, only after a period of one to three hours; that under certain conditions it acts as a vaccine. They also proved that the duration of immunity so produced is short; the greater the quantity of serum injected, the longer this immunity remains. Its principal characteristic was its rapidity of action and its efficacy against all venoms whether from Colubrine or Viperine snakes. They found that this antivenine is easily kept, as it does not lose its protective properties when heated to 140° F.

This antitoxic serum is prepared in the following manner. Injections over the shoulder were given to healthy horses subcutaneously of a solution of dialysed venom in increasing doses for a period extending over months, generally sixteen, each injection usually producing severe local reaction and abscesses. When the horse is sufficiently immunised, he is bled from the jugular, the blood is kept in a dark room for twenty-four hours, after which the serum is syphoned off, divided up into 10 c.c. bottles ; these are sterilised at a temperature of 10° C. on three successive days, the bottles being kept in a dark room, as is necessary with all other antitoxic serums.

The serum is useless for therapeutic purposes unless it is able to prevent death in a rabbit when given intravenously in a dose of 1·5 c.c.

It was found that the antivenine, like the toxin of the venom, is mainly carried by the leucocytes and not by the serum, for if the effusion from the peritoneal cavity of a vaccinated rabbit in which peritonitis has been excited be centrifugalised, the leucocytes which are deposited are found to possess a high antitoxic power, while the plasma has but little.

If the antitoxic serum be heated above 68° C., it becomes coagulated and is useless.

The practical results of the late investigations may be thus briefly stated :—

(1) That the injection of a sufficient dose of antivenomous serum (10 to 20 c.c.) prevents the toxic action of a lethal dose of venom given *later*, as would occur frequently when a ligature was applied above the bitten part at once, the venom having been kept out of the general circulation until after the patient had been injected with the serum.

(2) That the injection of a sufficient dose of the serum prevents intoxication by a lethal dose of venom given subcutaneously *before*, provided too long an interval has not occurred, which would include those cases where a ligature was not employed, or had been imperfectly applied, so that the poison had gained access to the general circulation.

(3) That as the resistance of man to the toxic action of the venom is greater as compared with the smaller animals, a much smaller dose proportionally of the serum is necessary to counteract the toxin.

(4) That if the venom has been injected directly into a vein, the result is always fatal, unless the serum be injected intravenously before or at the same time.

(5) That the serum should be at hand in all districts where snake-bites are common, and that the inhabitants should be instructed in the advantages derived from its use ; particularly as the amount of venom usually injected by the snake is little above the minimum lethal dose, an interval of one to three hours being in most cases allowable between the time of the bite and the injection of the serum.

(6) That when toxic symptoms are already present, the serum should be at once injected *intravenously*.

(7) That none of the ordinary precautions should be omitted even when the serum is available.

The following two cases show the efficiency of the serum treatment :—

One reported by Keatinge and Ruffler was that of a girl in Egypt bitten in the forearm by a snake believed to be a cobra ; she became unconscious almost at once, and when seen was cold and collapsed with imperceptible pulse ; 20 c.c. of antivenine were injected under the skin of the abdomen and three hours after 10 c.c. more ; from that time she gradually recovered. The second case is recorded by Rennie. A boy aged eleven in India was bitten on the right foot by a krait. In three minutes 8 c.c. of serum was injected into the subcutaneous tissue of the abdomen, hypodermic injections of pot. permang. being used locally. The boy made a good recovery.

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POISONOUS FISH, DISEASES AND INJURIES ATTRIBUTABLE TO THEM.

The subject of poisoning by fish is one on which there is very little recent information of any reliable character. Many ill-effects in different parts are frequently put down to the ingestion or even handling of them. It may be stated, however, with certainty that these are more common in tropical than in temperate regions, no doubt due to the much more rapid decomposition of the fish in the presence of heat and moisture, and perhaps to the fact that as all animal life is more abundant in warm climates, so the increased competition in the struggle for existence has caused many fish to have developed peculiar organs having protective and poisonous qualities. The noxious characters, as far as man is concerned, may be divided into—

(1) Toxic effects produced by the poison contained in the fish itself when fresh.

(2) Toxic effects produced by the ingestion of fish undergoing putrefaction either before being swallowed, or under certain conditions after it has been a longer or shorter period in the intestinal canal.

(3) The introduction into the body of specific pathogenic micro-organisms through the agency of the fish.

(4) Cutaneous wounds produced by the special armament of certain fish.

(5) Diseases or growths produced by parasites of which the fish is the definite or temporary host. In the constant investigation of fish markets for zoological purposes, particularly in the Indo-tropical and Chinese regions, I have been much impressed by the large number of apparently dangerous-looking fish that are habitually sold, and the advanced stages of decomposition which some of them frequently present, yet they seem to be used for food by the poorer classes habitually.

There used to be an old rule in the Navy that scaled fish were wholesome and that fish without scales were not. This, however, is certainly not altogether correct, as many with large scales, as *Sphyræna, Pagellus,* etc., are at times markedly poisonous; others without scales, as the fresh-water *Siluroids,* are esteemed as excellent food.

As a matter of fact, poisoning directly due to the consumption of fish is very rare in the naval service, and also among well-to-do Europeans in tropical regions.

The toxic properties inherent in fish, as Dr. Günther pointed out, may depend on various conditions; some are only poisonous at certain stages of growth, others only at special seasons, as at the breeding time; again, others are apparently dangerous after they have been feeding on poisonous foods; thus most of those beautifully-coloured fish belonging to the families *Squamipinnes* and *Labridæ*, which frequent coral reefs and browse on the polyps of the young growing madrepores, etc., are generally considered to be dangerous; nevertheless, if these be properly cleaned before cooking, most may be taken with impunity. French medical officers have pointed out that many fish at other times wholesome become poisonous in the breeding season, and every one knows that a spent trout or salmon is very liable to give rise to gastric disturbance if eaten.

The symptoms of poisoning due to fish fall into two distinct groups: (1) true gastro-enteritis with colic and high fever, probably due to a *bacterial infection;* (2) nerve symptoms, often commencing some time after the ingestion of the food, attended by constipation, and various forms of paralysis, etc., probably due to *intoxication from the alkaloid substances* produced during decomposition.

The following fish are credited with producing poisonous symptoms when taken fresh :—

(1) *Pagellus erykhrinus,* a "sea bream" common in Indo-Pacific waters, quoted as nearly causing the death of Quiros, the Spanish navigator, and also described as poisonous in Cook's *Voyages.*

Lethrinus mambo in the South Pacific is said to be poisonous when full grown but harmless when young.

Many of the *Squamipinnes* or Coral fish, as before stated, acquire poisonous properties from their food. These fish are generally gorgeously coloured, and are like butterflies in the aqueous gardens which they frequent.

Sphyræna, or "Barracudas." Their flesh is as a rule eaten with impunity, but two species in the West Indies are known to occasionally produce intense symptoms of poisoning—gastro-intestinal irritation with pain, vomiting, and diarrhœa, etc., followed by marked prostrations and, in a few cases, death from syncope. If the fish is unwholesome, Poe states that the teeth become blackened at the base, and natives say that if a silver coin placed on the flesh becomes black, the fish is unfit for food.

Some of the mackerels frequently cause gastric irritation; several species of *Thynnus* or tunny are stated by Günther to be poisonous at times—being red-blooded fish, they are liable to rapid decomposition. The *Carangidæ*, horse mackerel or yellow-tails, have a very bad name at the Cape of Good Hope as being poisonous, especially when they are old, *C. falax* being the most dreaded. Almost every variety of this genus may be seen in the market at Aden for sale. After eating poisonous *Bonito*, *Tunny*, and *Horse Mackerel*, the symptoms are those of mild gastric enteritis, with urticaria, giddiness, headache, vomiting, and diarrhœa, which may assume a choleraic form, ending in collapse and death.

Fish of the herring family are undoubtedly very frequently extremely poisonous. Günther gives the following list :—

Clupea thryssa, the sardine doré of the W. Indies, often causes a rapidly fatal issue. There is a saying that "if you begin at the head you never finish the tail." The symptoms are pain, prostration, convulsions, and unconsciousness followed by death, sometimes in a quarter of an hour, but generally in from two to three hours.

C. longiceps, C. perforata, C. venenosa, the three latter from the Indian Ocean, are all known to have caused intense purging and collapse.

C. humeralis of the W. Indies is stated by Day to have caused death in a few minutes.

The marine "cat fish" or *Siluroids* are as a rule too loathsome to ever be much used for food. They are invariably rejected, if caught, on board ship, but are, however, constantly seen for sale in the native markets. Most of the species of *Balistes* (file fish), *Tetrodon* (globe fish), and *Diodon* (porcupine fish) are rejected as being poisonous ; they are foul feeders, or live on coral and other zoophites. Two cases are recorded by Sir John Richardson of acute poisoning from eating portions of the liver of a Tetrodon. One man ten minutes after eating it became very ill, with flushed face, swollen lips, signs of intense gastro-intestinal poisoning, followed by paralysis, laboured breathing, cyanosis, and death in seventeen minutes. The second man died in twenty minutes. The whole fish was not more than eight inches long. Many of the small kinds are constantly seen for sale in the Bombay market and elsewhere, those from brackish and fresh water being more wholesome than the marine varieties. Macoy states that in Australia nearly all cases of fish poisoning are due to eating *Arripis truttaceous*, one of the sea perch. This may be sometimes due to decomposition, but fresh fish also produce unpleasant results in some people, the symptoms being flushing of the skin, particularly of the face, headache, vomiting, and a transient eruption, generally followed by rapid recovery, but a few deaths have been noted.

Muræna punctata, one of the "sea eels," is stated by Russell to be poisonous if eaten. Mosso states that the fresh blood of eels possesses highly poisonous properties, due to the presence of ichthyotoxin, like the toxalbumens of vipers.

Mussels or other shell-fish, though quite fresh, will sometimes produce severe symptoms—nausea, vomiting, diarrhœa, syncope, numbness of the limbs, and eruptions on the skin, with occasionally swelling of the tongue and mucous membrane of the throat. Those taken from the open sea are generally quite wholesome, the poisonous properties being derived from the foul water from which they have been gathered.

(2) *Putrefaction of Fish.*—This is the most common cause producing poisonous symptoms.

It is generally due to the action of micro-organisms breaking up the proteid substances present into a number of chemical bodies, some of which are harmless, others being very toxic.

The proteids are first split up into albumenoses, and then finally into the animal alkaloids known as "Ptomains" ; these latter were first studied in detail by Selmi, and since then by Breiger, Van Ermengen, Sydney Martin, and others.

From decomposing fish Breiger isolated the following substances : *Trimethylamine, Dimethylamine, Methylamine, Neuridine, Cadaverine,* and *Putrescine* ; some, as cadaverine and putrescine, are but slightly toxic, others are extremely so, rapidly causing death.

All "Ptomain" poisons are characterised by the combination of marked nervous symptoms, with gastro-intestinal irritation, and a tendency to coma, in which the patient may die. There is also almost always a more or less prolonged period between the ingestion of the food and the onset of the symptoms, "the incubation period"; when this is present, the cause of the poisoning, according to Van Ermengen, is due to the presence of a special organism, *Bacillus botulinus,* this condition being known as Botutism. David describes an interesting instance of poisoning by red herrings. There were five cases, all in one family. Gastric symptoms and obstinate constipation commencing some days after taking the food, occurred in all, followed by local paralysis of parts, double vision, and diminished reflexes. In two the dysphagia was so complete that feeding by a tube had to be resorted to. The paraplegic symptoms lasted for months, but all finally recovered.

Breiger isolated an alkaloid named *Mytelotoxin,* which is not destroyed by cooking, from the liver of mussels taken from foul water; this produces acute symptoms like those of "curare" poisoning, affecting the motor nerves, being quite distinct from those toxins which induce the gastro-intestinal irritation symptoms.

The treatment of all cases of Ptomain poisoning is to clear the stomach and intestines of the irritating substances as soon as possible, to give stimulants with discretion to counteract the cardiac depression, and where there is profuse diarrhœa and much pain opiates will be required; for the subsequent paralysis, massage and nerve tonics. "Tinned fish" are very liable quickly to undergo putrefactive changes, especially in hot climates; if then eaten, they produce severe symptoms, diarrhœa, vomiting, and collapse in a few hours, which may last for days or prove fatal.

In tropical climates, where the intestine is so ready under slight provocation to increased secretion, congestion, or ulceration, one cannot be too careful in the scrutiny of all tinned fish to be used for food; it is from these that on board ship fish poisoning most commonly arises.

(3) *The conveyance of specific pathogenic micro-organisms to man,* by means of oysters, mussels, etc., unquestionably takes place, perhaps more often than is generally believed.

The spread of typhoid has been distinctly traced to infected shell-fish, and reported accordingly by many medical officers of health and others. It is not uncommon in certain well-known localities to find oyster beds on the foreshore, immediately below the outfall of a sewer, and I have had it *stated to me* by a "grower" that in these positions the oysters are fatter and better in quality than those from more open situations.

Bacteriological examinations have been made demonstrating the presence of *B. enteritidis* and *B. colecommunis,* etc.

Legislative measures for removing this evil have been over and over again brought forward, but so far ineffectually, the interference with the oyster industry and restriction of the area for beds being strongly opposed by a certain section of interested persons.

(4) *Poison Wounds caused by Fish.*—Perhaps the most widely feared fish producing cutaneous injuries are the "Sting Rays," belonging to the order *Batoidea.* These have one or more sharp barbed spines attached to some portion of the dorsal surface of the tail; these may cause severe lacerations when incautiously handling the fish, or when stepping on them while half hidden in the sand. In the first case I personally came across, the pain was so intense that the strong, healthy man almost fainted. There is no poison apparatus connected with the spines, but they are like poison arrows, being coated with mucus from the surface of the fish, which has peculiar irritating properties. Another class of fish, the *Scorpœnidœ*, are profusely provided with sharp spines on the opercular plates, fins, etc., which inflict irregular punctured wounds. Among the very dangerous fish are *Synancea verrucosa* and *S. horrida*, found in the Red Sea and on the coasts of Africa and India; in these species the dorsal spines are grooved, having small poison bags attached, the venom being injected into the wound by pressure. Injuries from this fish occasionally cause death (Day). The symptoms vary according to the amount of venom injected; they are local pain, increasing and spreading from the wound, with swelling of the part, lymphangitis and gangrene, attended with convulsions, delirium, and attacks of syncope.

Other very dangerous fish are the *Thalassophryna*, of which two species are known, one in the Pacific, the second in the Atlantic Ocean. These fish, according to Günther, possess as perfect poison sacs and tubular spines as any venomous snake. The poison sacs are attached to the bases of the opercular and dorsal spines.

In the "Weavers" *Trachinus*, common in European waters, the dorsal and opercular spines have deep double grooves, these being filled with fluid mucus, but there is no true poison apparatus. Wounds inflicted by them are followed by violent inflammation of the injured part.

Many genera of the "cat fish" tribe *Siluridœ* are excessively dangerous to handle, the dorsal and pectoral fins having very hard serrated bony spines, which may inflict serious wounds; in some of these fish glandular organs are found at the axils of the spines; the body is covered by an offensive tenacious mucus, which can readily inflict the wound. Great numbers are commonly eaten by the lower "castes" in India, they are therefore frequently caught; the fishermen immediately cut off the offending spines, it being rare to see a perfect specimen in the market.

Treatment of Wounds.—These should be enlarged and the blood allowed to flow freely, or the part may be ligatured above, and the poison removed by cupping or sucking the wound, then ammonia or spirits of turpentine may be applied, followed by fomentations, opium being given and stimulants as necessary. The wounds caused by the serrated spines of rays and cat fish almost always suppurate.

(5) *Fish may act as intermediate or definite Hosts.*—An example of the former is found in *Lota vulgaris,* which is commonly known to harbour the larval form of *Bothriocephalus lotus* (see Cestodes). Congers are said to be infested with hydatids. A curious case has been described by Dr. Batten, namely, the fixation of a species of *Lepcophtheirus*, one of the "Calegidæ" or fish lice on to the cornea of a fishmonger (which specimen he kindly sent to me). These semi-parasitic copepods are very numerous on many flat fish, moving about actively on the skin some time after the death of the fish. The saline condition of the ocular conjunctiva, with a certain quantity of mucous secretion, render this position particularly suitable for these parasites if accidently introduced. It is, however, very rare : I have never heard of or seen a second case. The parasite was successfully removed, vision not being impaired.

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MISCELLANEOUS NOTES.

No. I.—SIZE OF REMARKABLE TREES.

Mr. L. Augusto has kindly measured the great *Gouralr Chintz*--the Baobab—*Adansonia digitata* near the Custom House at Mora, Karanja (Bombay Harbour), and reports it to be 30 feet 5 inches in circumference at 4 feet from the ground.

G. MARSHALL WOODROW.

KELVINSIDE, N.,
GLASGOW, *January* 1903.

No. II.—NESTING NOTES FROM KASHMIR.

I have spent the past summer in Kashmir, and it may interest oologists to read a few notes I have made on the nidification of certain birds whose nests and eggs are almost or altogether unknown. During April and May I was in the Astor District. On the 29th April, at an elevation of about 10,000 feet, I saw 3 young Nutcrackers—*Nucifraga multipunctata*—hardly able to fly, so this bird must breed very early. I think, too, it probably has 2 broods in the year, as I found a nest, containing young, in Sonamarg at the end of July. During May I found nests of *Tinnunculus alaudarius*, *Tetraogallus himalayensis*, *Pica rustica* and *Cinclus asiaticus*, but I was too early for eggs of the last two mentioned. June, July and August I spent in Sonamarg and in the higher valleys in its neighbourhood. Sonamarg itself has often been visited by egg collectors, but the higher alpine valleys round it appear to have been but little exploited. It is in these alpine valleys, from 10,000 to 14,000 feet, that many new nests may be discovered, and the best time to visit them is from the 20th June to the end of August.

Mr. J. Davidson, in the *Ibis* for January 1898, gives a very interesting account of 'a Trip to Kashmir' in search of eggs, and to any one intending to come up here for this purpose, it would prove of the greatest assistance.

No. 369. *Tribura major* is common at Sonamarg, and its characteristic note (Tic-tic-tic) loudly proclaims the bird's advent in the latter part of June. It is never met in the forests, but frequents the outskirts and the low bush jungle in the open meadows. I found 3 nests in July, but only secured one clutch of eggs. The nest is a small cup of grass lined with fine grass, placed on the ground in thick herbage, and is difficult to find. The eggs, 3 in number, are pinkish white spotted finely with reddish brown, and average ·74″ × ·57″ in size. The bird does not appear to breed below 7,500 or above 10,000 feet.

No. 405. *Phylloscopus affinis* I found breeding plentifully during July in the Juniper scrub from 11,000 to 13,000 feet. The nest is globular, loosely built of grass, lined with hair and feathers and is placed from 6 inches to 2 feet from the ground. The eggs, three or four in number, are either plain white, or white spotted sparingly with cinnamon red. The plain and spotted eggs sometimes occur in the same nest. The average size of the eggs is ·62″ × ·47″.

No. 589. *Alseonax ruficaudus.*—This Flycatcher is not uncommon in the Sind Valley from 6,000 up to 10,000 feet, but its nest is extremely hard to find owing to the bird's shyness, and it deserts it very readily. I found 3 nests in June of the usual Flycatcher type placed from 20 to 30 feet from the ground, in every case the nest was against the main trunk and resting on a small branch of the tree. The eggs (I secured but one clutch) are pale green, very faintly spotted at the larger end with reddish brown, forming a well-defined ring.

No. 644. *Ruticilla rufiventris.*—The Indian Redstart was quite common in the higher valleys above 10,000 feet, being most common over 12,000 feet. I found only two nests, both in July, one of which was placed on the ground between two stones near a stream; the other, also near a stream, was built in an indentation on the side of a large rock about 4 feet from the ground. The nests were cup-shaped, made of grass, lined with fine moss, some horsehair and a few feathers. The eggs, 3 in number, are buff in colour, speckled finely with red; the average size being ·80″ × ·57″.

I have read Captain Marshall's 'Notes on the Birds near Quetta' published in the Journal of 18th October last, in which he states that the eggs of this Redstart are pale blue in colour. In both the cases quoted above, I unfortunately failed to kill the bird off the nest, but I examined the bird through a field glass for over half an hour, and the same morning killed a pair of the same species which I was able to identify.

No. 651. *Calliope pectoralis.*—The nests of this bird, which I found, were at an elevation of about 11,000 feet. They were cup-shaped, made of grass, and placed on sloping ground under a tuft of grass or small bush. The eggs, 3 or 4 in number, are pale greenish blue, faintly spotted with reddish brown at the larger end. The bird breeds from the middle of June to the end of July.

No. 712. *Accentor nepalensis.*—The Accentor was breeding early in July at a height of 13,500 feet. I found 2 nests placed on the ground under shelter of rocks; they were cup-shaped, made of grass and moss, and lined with fine grass. In one nest were 3 fresh eggs, in the other 2 nestlings and one addled egg. I left the former to see if the bird would lay more, and on the following morning, on returning to the nest, found that the eggs had been broken, and only one of them was sufficiently whole to admit of being patched up. The eggs are large for the size of the bird, the average of the two eggs I secured being ·94″ × ·69″. They are pinkish white in colour, and plentifully speckled with red, chiefly at the larger end.

No. 758. *Propasser rhodochrous.*—I found two nests of this bird in the first week in August, at an elevation of about 10,500 feet. The nests were cup-shaped, made of twigs and grass, and lined with horsehair: they were placed 3 or 4 feet from the ground in bushes; the eggs, four and five in number respectively, are a bright blue, with a few large black spots, chiefly at the larger end. The average size of the 9 eggs is ·72″ × ·53″.

No. 787. *Fringillauda sordida.*—Large flocks of these birds are often seen in the Kashmir valleys during the spring migration, and it is one of the commonest birds in the higher valleys near Sonamarg during the summer. They did not begin to breed till the middle of July, and I fortunately secured several nests at an elevation of 12,000 to 13,000 feet. The nest is made of grass, and lined with horsehair and a few feathers: it is placed in a hole under a rock, and the tunnel leading to the nest is sometimes as much as 2 feet long; in two instances the holes were like those made by a rat in open flat ground. The eggs, generally four and sometimes three in number, are pure white with considerable gloss, and are somewhat pointed at the smaller end: average size ·82″ × ·59″.

KENNETH BUCHANAN, MAJOR,
4th Sikhs.

SRINAGAR, *December*, 1902.

No. III.—NOTES ON A FEW CATERPILLARS OF INDIAN SPHINGIDÆ.

1. *Acherontia lachesis.*—A larva found in Poona in October 1898 had the ground-colour a bright gamboge yellow instead of green: this tint may have just been assumed preparatory to pupation as the insect was full-grown, but it did not cease feeding until 3 days after being found.

2. *Polyptychus dentatus.*—Hampson describes the larva as "green, with yellow marks down the back, outlined in pink, &c." Two specimens obtained in August 1898 and a third in October of the same year in Poona, had no trace of pink or yellow on the back which was of a uniform bright green, while the sides were dull green in ground-colour. Others obtained from eggs and fed on the same plant had the normal pink and yellow markings.

3. *Chœrocampa theylia.*—Three forms of this larva are given in Hampson's book; I bred a number of the first of these here in Sadra last September. In my experience the brown colour was only assumed in the final stage and not always then, the larva being invariably green in the earlier stages and sometimes in the last stage also: the green had occasionally a pink tinge. The pupa very long for the size of the moth.

4. *Chœrocampa celerio.*—My experience of this caterpillar does not at all accord with Hampson's description, *i.e.*, "Brown: a series of whitish ocelli with darker centres from 4th to 10th somites; horn and underside white." In September 1900 near Palanpur I found two forms: the first, of which I obtained several specimens, feeding on 3 different plants (one the grape-vine), was green, with *2 ocelli only,* one on the 4th, and a smaller one on the 5th somite. The second form, of which I obtained one specimen at Palanpur and have bred another this year in Sadra, was brownish purple in colour with numerous dark strigæ on the dorsal area, a paler broad lateral stripe, pale sub-dorsal line from 1st to 4th somites; 2 ocelli, as in the green form, on the 4th and 5th somites, the first and larger one being yellow with dark centre flecked with blue; legs and horn crimson. I do not profess to know much about Indian moths, but the perfect insect produced from both the above forms of larva

agrees with the description of *C. celerio* in Hampson's book, and is certainly the moth labelled as "*celerio*" in the Society's collection. It is, except *C. theylia,* about the commonest of the genus in the Poona District and in Guzerat.

5. *Protoparce convolvuli.*—In Poona, October 1898, I obtained 4 larvæ feeding on a species of wild convolvulus in which the ground colour was a dull grey-green thickly covered with brown strigæ : a broad lateral white line, the oblique stripes indistinct. Head brown with black markings, horn shining black above, yellowish below. Resulting pupa and imago typical "convolvuli." I also found the normal green form on the same food-plant in the neighbourhood.

A. H. MOSSE, Lieut., I.S.C.

Sadra, *December* 1902.

No. IV.—NUMBER OF EGGS OF THE DABOIA (*VIPERA RUSSELLI*).

On the 5th March last, at Mahisa, in the south of this Agency, I killed a female daboia rather more than 4 feet in length which contained 55 eggs. I opened several of them, but in none was there any trace of the embryo.

I regret that I did not make fuller notes at the time, but so far as my recollection goes, all except 3 or 4 of the eggs which I counted were fully formed.

In this part of Guzerat the local name for this snake is "Chitar."

A. H. MOSSE, Lieut., I.S.C.

Sadra, Mahi Kantha, *December* 1902.

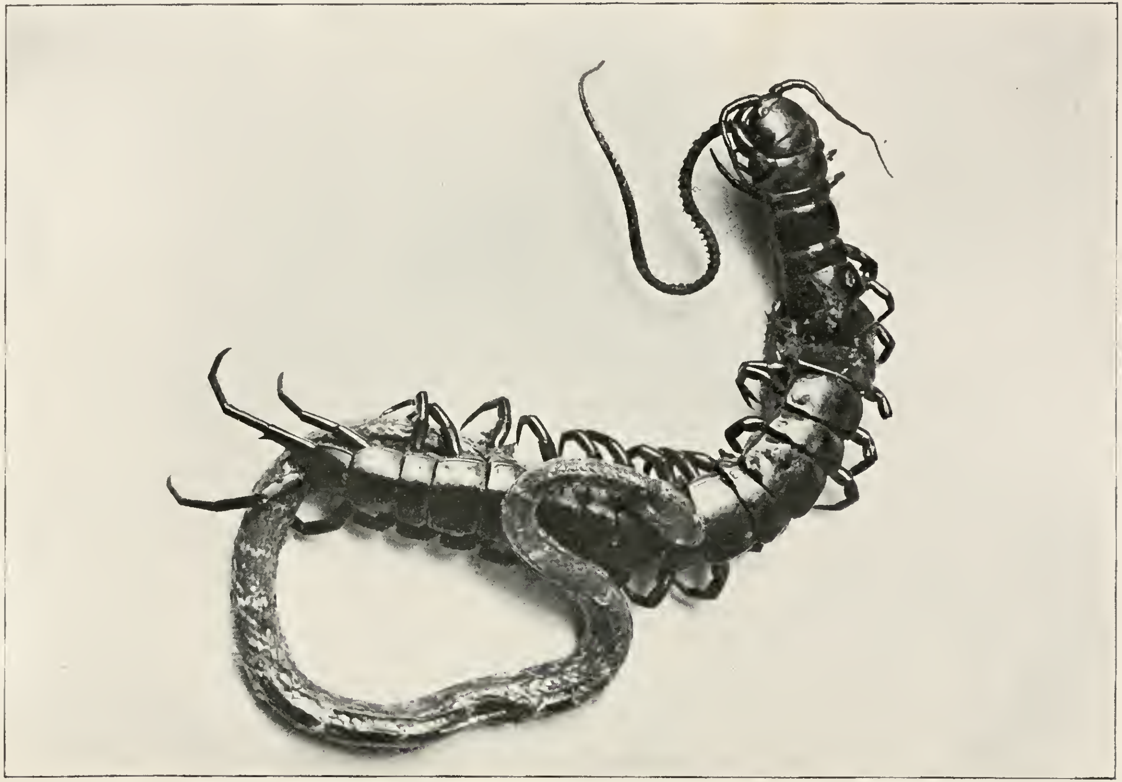
No. V.—THE INCUBATION OF A CUCKOO'S EGG.

At the end of August last year I found in Baroda a nest of the Large Babbler containing 4 eggs of its own, and a fifth of the Pied Cuckoo (*Coccystes Jacobinus*). When I blew these eggs the former proved to be comparatively fresh, one of them, only, containing just a tinge of blood, whereas the Cuckoo's egg seemed to have been sat upon much longer, the embryo being considerably advanced towards development and the eye-balls formed.

Now it is hardly likely that the intended foster-parents would take no notice of an egg deposited in the nest before any of their own had been laid ; wherefore it must be presumed, I think, that at least one or two of the Babbler's eggs had been longer in the nest than that of the Cuckoo. The inference then is that the Cuckoo's egg incubates more quickly. If this is so, the object may be to enable the young Cuckoo to hatch before the others and either turn them out or from its superior age and strength obtain more than its fair share of food. Or the idea may be to give the Cuckoo a chance to make up for lost time if its mother is late in depositing her egg in the nest. These may be fanciful speculations on an isolated case, but I should very much like to know if anything of the kind has been noticed before ? I have not heard of a similar instance.

A. H. MOSSE, Lieut., I.S.C.,
Assist. Political Agent, Mahi Kantha.

Sadra, *December* 1902.



Mintern Bros., Photo-Eng., London.

A CENTIPEDE EATING A SNAKE.

No. VI.—A CENTIPEDE EATING A SNAKE.

(*WITH A PHOTOGRAPH*).

I believe it to be a fact that Centipedes in general are eminently raptorial in their habits, attacking anything that they can overpower. It never occurred to me, however, that a Centipede would be bold enough to attack a snake as appears to be the case in this instance. Considering the subject worthy of record, and possibly of interest to members, I had a photograph taken about half the real size, depicting the Centipede and snake in the position I saw them and in which I understand they were found.

The specimens were received by Dr. Pedley, who sent them home (unfortunately before they were identified) to his son for the Marlborough College Museum, and it is to him I am indebted for the following information.

They were found on the floor of a house at Kokine, a suburb of Rangoon, the snake alive and writhing in the clutches of the Centipede. They were killed and at once transferred to a jar of spirits, and the owner thinking the incident an unusual one sent the specimens to Dr. Pedley. An inspection of the photo will show that the skin and flesh for about two inches has been completely removed from the tail of the snake and presumably eaten by the Centipede, which was one of the common large brown unstriped variety often met with in this part of the province.

It would have been very interesting to know if the snake was uninjured before the Centipede attacked it, but in any case as the snake was alive when found, it might still have held its own against the Centipede. I shall be glad if this note and photo should prove to be of any interest to members of the Society.

W. P. OKEDEN.

RANGOON, *January* 1903.

No. VII.—A MAN-EATING PANTHER.

The panther first began man-eating in this district in the rains of 1901: apparently he came from the Dangs, as his first kills were in the villages bordering on those native states. I think he probably took to man-eating on account of the 1900-1901 famine which was very bad indeed in the Dangs, many people dying out in the jungle (I have myself seen skulls of those who tried to get into British territory but died by the way); during the famine the deer and pig in the forests would naturally diminish on account of the Bhils and Konkanis being hard up, and this together with the circumstance of people moving about in the wildest and least frequented parts in search of edible fruits and roots probably led the panther on some extra hungry day to take to man for food. The first man he took was probably dying or asleep in the jungle. I did not hear of the man-eater till last February when my camp was at Mulher in the centre of the valley where he was killing: his beat in the Mulher Valley was about 7 miles long and 3 broad. I remained 10 days at Mulher trying my best by means of "holding the hills," beats and sitting up over kills to get the beast, but was unsuccessful and could not stay any longer. About a month later while I was in the Peint Range I received word that he was man-eating again, and so as the moon was waxing I determined to go back to Mulher and have one more try,—a long tiring journey of over 60 miles by road (with no springs) and 40 miles by rail. I stayed at Mulher a week, but never once saw the beast and had to go. Men were killed in August and September, and in November my work took me to Ajmir Saundana within 22 miles of Mulher, and while at Ajmir I heard on the 26th of November that the panther was killing again. I at once went to Mulher, but it was not till the 4th of December that the beast was killed; I should have had to leave on the evening of the 4th as I could spare no more time after him, so luck was with me at last.

On the 3rd, at noon, I heard a boy of 15 had been killed at Wadai, 4 miles from my camp; this boy was most unfortunate. Last year the panther had tried to get him, but only mauled one leg; my wife and I were able to dose the wound with carbolic oil and the boy got well; this time he and one or two others were sitting close to a bright fire on a threshing floor near the village in the early part of the night and the panther came and carried him off: the panther took him about a quarter of a mile to a patch of high grass and brushwood and ate all he could of the head, the flesh of one leg and all his inside; so there was plenty left for the beast to come back for. The body was dragged into deep shade under the brushwood and there was no tree anywhere near to sit up in, so four holes were made in the ground and a wooden post put in each; a cart was then taken off its wheels and lifted on to the top of the posts so as to be about 8 feet from the ground: the cart and posts were then hidden in branches and grass, only a small opening being left to shoot through. An avenue was cut through the brushwood so that I could clearly see the body from the erection, which was about 35 feet from the kill. At 3-30 p.m. I was sitting as quiet as a mouse in the cart and had sent all the men back to the village. At about 4-30 I distinctly heard the panther coughing about a quarter of a mile away. In another hour's time and without any warning the beast growled just *close* behind me; I had been absolutely still and he could not have seen me and so probably he scented me because of my erection not being far enough off the ground. I did not turn or move, hoping he would in a few minutes come round to the kill in front; but he was too cute, and it got darker and darker till at 6-30 I could not see the body at all: there was a crescent of a moon, but it was useless, as the body was in deep shade. At about a quarter to seven I settled to turn up my hurricane lamp and hang it outside on one of the front posts and about 7 feet off the ground: I did so as quietly as I could and the light shone well on to the body.

I now felt as if my best chance had gone, but settled to sit right through the night till morning. At 8-30, after the moon had set, when looking towards the body I saw a grey mass beyond it which had not been there before, so I knew the panther had come at last and was more thankful than I ever remember being in my life. He looked most weird as of course he had come absolutely noiselessly, and he gradually got nearer and nearer and looked whiter and larger and more like a ghost than anything. When he got up to the body he half turned his side although still looking straight towards me, so I settled to shoot. I had purposely put an expanding bullet in the left barrel of my ·450 express and a solid one in the right and meant to shoot both barrels at once (a finger on each trigger) as the lamp invariably goes out with the concussion of the air so that one cannot get in a second shot. I aimed at his body behind the shoulder as far as I could and pulled both triggers; a flash, a loud report and total darkness, and then I listened and heard the panther crashing down the hill for about 5 seconds, then quiet, and then a groaning growl; so I knew he was hard hit. Nothing more could be done till morning so I went back to the village, and after a fine drink of milk tried to sleep on a bed of chaff thrown down on the ground under the eaves of a hut, but a rat which would try to walk over my face, numerous insects and cattle and goats a few feet away in the hut hardly allowed me a wink the whole night. At sunrise we started off to the kill: we found blood very soon and tracked very cautiously: the tracking was easy, as there was a lot of blood but there was plenty of cover so one had to be careful. The panther had gone down to the stream bed and after about 15 minutes we saw the body stretched out on some rocks ahead with back towards us. I threw a small stone towards it but there was no movement so I went up to within 10 yards' distance. I then was pretty sure he was dead, but threw a rock at him to make sure, when to my surprise he lifted his head to look at me. I fired two solid bullets into his head and all was over. He was a splendid male 7′-3¼″ long and the length of the middle toes in his fore feet showed he was the man-eater of last hot weather. One of the bullets of the night before had struck him in the stomach and the second (the solid one) had broken one of his hind legs.

When first he took to man-eating he would never touch any one unless he (or she) was lying down and unless it was quite dark with no moon or fire or light burning; under these circumstances if no one were sleeping outside he would go right into a hut if the door were open and lay hold of one of those asleep: if he happened to grip by the arm or leg and the victim yelled out then probably the panther would let go and try his luck elsewhere, but if he laid hold at once by the throat so that there could be no cry, then the man, woman or child would probably be carried out of the hut before the others sleeping near knew anything at all.

He had got bolder however lately and the kill before the last was in broad-day-light and I went and saw the place (in Gad forest on the Dangs boundary). Villagers had been cutting rosha grass and were taking their head-loads to the still, the last couple being a woman and her boy (or girl), who it seems were some way behind the others; the panther had crouched in high grass within 5 feet of a forest foot-path; I saw the patch of blood close to the path and some 10 feet from the grass where the panther must have sprung from, and the marks showing the way the panther had dragged off the woman, but her remains were never found and nothing was heard of the child, so both must have been killed and eaten.

The following list shows the damage done by the panther in the Mulher Valley : he was probably the beast which did the man-eating in the Dangs and also in the part of the Pimpalner Range of Khandesh adjoining the Mulher Valley, but I can give no figures for damage outside the Nasik District.

Number of people killed at once	24
„ „ „ who died subsequently from being mauled	6
Total deaths in Mulher Valley... ...	30

Number of people who were mauled but recovered, 11.

L. S. OSMASTON,
Deputy Conservator of Forests.

CAMP BHOWLI, NASIK DISTRICT,
January 1903.

No. VIII.—NOTE ON THE BREEDING OF CERTAIN HERONS, ETC. IN SOUTHERN INDIA.

In Hume-Oates, under *Herodias alba* (Vol. III, p. 238), is mentioned a resort near Madras where many waterfowl used to congregate for breeding.

On coming across this reference I decided to find out whether the place retains its old reputation in this way, and accordingly made inquiries last summer concerning it. The result of these inquiries was full of promise and I decided to visit the place, should I get an opportunity.

As soon as the N.-E. Monsoon set in I communicated with Mr. A. C. Tate, I.C.S., Judge at Chingleput, who very kindly instituted searching inquiries for me.

The monsoon came late and the tank at Vaden Tangal remained empty until November 6th when heavy rain half filled it. The birds lost no time and appeared on the 8th. The villagers said it usually took thirty days for the birds to lay, dating from their arrival. I accordingly decided to visit the place about December 10th.

Happening however to be in Madras on duty at the end of November and with a couple of days to spare, I thought it would be as well to go over and see how the birds were progressing ; and well it was I did so.

I went over to Chingleput on November 30th and through Mr. Tate's excellent *bundobust* was enabled to spend a most instructive day on December 1st.

Leaving Chingleput at 5 A.M. in a pony *jutka*, a 13-mile drive brought me to within 3 miles of Vaden Tangal, which was reached in a bullock cart.

On arriving at the tank I found a raft prepared, and started at once to explore the nests. I found trees and tank exactly as described in Hume-Oates. I found only 5 kinds of birds breeding, *viz.*, 1527 *Phalacrocorax fuscicollis*, 1553 *Anastomus oscitans*, 1554 *Ardea manillensis* (a few pairs only), 1555 *Ardea cinerea*, and 1568 *Nycticorax griseus.*

The natives, however, assured me that at this time there are usually 10 varieties breeding and that later on 3 more come. They gave me the Tamil names of these. With the exception of *A. manillensis* the birds were in thousands and I must have seen many thousands of eggs during the day.

At the bottom of page 239 of the article above quoted occurs the following passage:—" Can it be that any of the birds that breed in the South in December and January breed again with us in July."

That the birds are the same I am satisfied. *Anastomus oscitans* was without exception, in grey plumage. I saw many specimens of *P. fuscicollis* with white breasts and saw many on the nests without the white tuft behind the ear coverts. Some specimens of *N. griseus* were in very bedraggled plumage, it being evidently their second brood, and the young of the first brood appeared to be with them.

Of *A. manillensis* there were perhaps 8 or 10 pairs, but these birds were so shy that I had great difficulty in identifying their nests, and only really managed to satisfy myself in one case.

I believe the sole difference between the nests of *A. manillensis* and *A. cinerea* is that the former have some pretence at lining in the form of rather smaller sticks whilst the latter have none.

A. oscitans kept entirely to themselves. *P. fuscicollis* and *N. griseus* did not appear to like each other, but appeared to put up with the 2 larger herons.

The eggs of *A. oscitans* were in all stages of incubation, the number of eggs in a full clutch being invariably five. The degree of incubation is perfectly easy to estimate from the amount of dirt on the shell, and in the same clutch may be found a perfectly white fresh egg and a dirty thing ready to hatch.

The young of *A. cinerea* are able to stand immediately on leaving the egg and it was interesting to watch them hatching. I saw birds that could not have been more than three or four days old picking vermin from each other.

This vermin appears like magic—there is no sign of it in the nests with eggs, which are of such construction as to give very little cover to insect life ; but no sooner are the young hatched than they become infested.

The water in the tank is very oily and foul, and I was told that not even cattle would drink it.

If I had gone ten days later, I should, I think, have got very few full clutches and certainly no fresh ones.

H. N. PACKARD, CAPT., R. A.

OOTACAMUND, *January* 1903.

No. IX.—QUEER FIND OF A PAINTED SNIPE'S EGG.

On 26th October last, Mr. H. A. Gass, Conservator of Forests, who was staying with me, told me that about a week before when he was dining with Mr. Jackson, I. F. S. at Coimbatore, the latter, when eating a snipe, came on an egg. On inquiry the snipe of course turned out to be *Rostratula capensis.* Mr. Jackson kindly sent me the egg which he had kept. Although it was in a highly putrid condition when it arrived and had a couple of fork holes in it, I managed to clean it out and make some sort of specimen of it.

H. N. PACKARD, CAPT., R. A.

OOTACAMUND, *January* 1903.

No. X.—BIRDS NESTING IN SOUTHERN SHAN STATES OF BURMA.

The following notes may be of interest to some of our readers :—

Nos. 458, 459 *and* 461. *Suya crinigera* (THE BROWN HILL-WARBLER), *atrigularis* (THE BLACK-THROATED HILL-WARBLER) and *superciliaris* (ANDERSON'S HILL-WARBLER). The above three, according to Col. Rippon's List of Birds in the *Ibis*, October 1901, are all found up here, the last being stated as *very common.*—I have found a good many nests of Suyas up here, but so far have failed to identify the birds as they all seem very much alike with slight variations, some having a supercilium, others indistinct ones, and again some without any signs of one at all, while again some have black beaks and others horn-coloured ones, the size also varying.—I have sent four skins to the Society, which have so far I believe stumped even them.—I found one nest on 1st June 1902 with two eggs, the bird agreeing with No. 461, *Suya superciliaris,* the eggs being pinky white with dull red spots. I found another nest on the 19th with four eggs, the bird agreeing with the same description with the exception that it had *indistinct subterminal patches,* but the eggs are pale green with dull red spots and a zone round the larger end.—I have other eggs white with red spots and zones, in fact I have three distinct types of eggs, but, unfortunately, the birds all seem to merge into each other. The nests are all the same, cylindrical, of woven grass down with a hole at one side near the top. If any kind friend can help me out of my difficulty I shall be very much obliged. Egg collecting has its disadvantages in these parts when one is not good at identifying species and has no specimens for reference, although I have been very lucky in my first season in getting a good many comparatively speaking rare eggs.

No. 611. *Pratincola leucura* (THE WHITE-TAILED BUSH-CHAT). I saw three or four of these birds near Fort Stedman on the 29th July 1902, so they must evidently breed round the lake.

Uroloncha topela. This bird was first recorded from the Shan States by Col. Rippon in the *Ibis* for October 1901, being the first record from within Indian limits.—I sent skins to the Calcutta Museum for identification. Mr. Finn kindly wrote saying "they are certainly not the ordinary Munia (*U. punctulata*) of India, but whether they are *U. topela* of China or *U. subundulata* of Burma, I cannot say." As it is highly improbable that two varieties are to be found up here, I think I am quite safe in recording its breeding from within Indian limits. It is extremely common up here during the rains, when it breeds from August to October (a few nests may be found in November). It nests at all heights from the ground and not near water. It seems to prefer thorn and bramble bushes, the orange-trees in the Government Orchard being particular favourites. The nest is of the usual Munia type with a decided porch over the entrance. Five to seven seem to be the usual complement of eggs which are white. Fresh and incubated eggs are often found in the same nest but never more than seven.

I have lately received the following note from Mr. Oates in regard to *U. topela*:—

"The Munias you sent me are near *topela*, but not quite like the Chinese birds. If I were writing 'The Birds of India' again, I think I should unite *topela* to *punctulata*. The various races are so like each other and so difficult to make out."

No. 739. *Sporæginthus flavidiventris.* THE BURMESE RED MUNIA. Breeds up here from September to December. I have found nests at some distance from water in spear grass, the nest being very hard to find ;—in fact the only way I have got them is while riding or out shooting by hearing the little bird get out with a "cheep" from under my feet. I have found two nests lined with feathers. As I do not see this mentioned in Blanford, it may be of interest.

Those nests found in September had five to six eggs, while those found in December had generally four incubated eggs ; this is probably due to it being the second brood.

No. 820. *Hirundo striolata.* THE JAPANESE STRIATED SWALLOW. I have found three nests of this swallow in October and November but have not been fortunate enough so far to get their eggs, as some one destroyed the nest before I could get them. I watched one nest for some time and one evening I got up to it and feeling something inside opened it, catching both birds but alas no eggs. It builds generally inside houses, making a long retort-shaped nest, which must be broken before one can see into it.

No. 1236. *Circus melanoleucus.* THE PIED HARRIER. This Harrier must breed up here as I saw quite half a dozen of both sexes near Saga, south of Fort Stedman Lake, on the 10th and 28th July 1902. The country down there is a huge swampy plain with a river running through the middle of it. I had no time to hunt for nests nor did I want to, as the swamp is full of leeches, but I had a good opportunity in watching them from my boat, as they beat up and down on both sides of the river. The only eggs I got on this trip were the Striated Weaver bird and Chestnut-bellied Munia, of which there were any amount nesting in the long grass within a few inches of the water along the river banks.

H. H. HARINGTON, CAPT.

TAUNGGYI, BURMA, *February* 1903.

No. XI.—RARE DUCKS.

Mr. W. Moore has this year obtained three specimens of *Eunetta falcata*, one of which was sent to me for identification ; all were young females.

Mr. N. S. Mondy has shot and given me a magnificent male *Anas zonorhyncha* (THE EASTERN SPOT-BILLED DUCK). The bird was one of three seen on the banks of the Brahmapootra River. Mr. Mondy believes he has seen others of this species before. This is the first recorded occurrence of the Eastern Spot-bill in really Indian limits.

Mr. Rose shot at the end of last year a fine male Pink-footed Goose, *Anser brachyrhynchus*. Messrs. Moore and Mondy saw two birds which, they *think* were of this species. The feet were of such a vivid pink as to attract attention when the birds were still far out of shot.

E. C. STUART BAKER.

DIBRUGARH, *March* 1903.

No. XII.—GAZELLE TAKING TO WATER.

The following incident may have interest for other members who, like myself, do not usually associate Gazelles with water :—

When riding on a camel early one bitterly cold morning, towards the end of January this year, along the bank of a wide and deep canal in the Hissar District, Punjab, I saw a Gazelle (*Gazella bennetti*) some little distance ahead on the same bank feeding along the grassy edge of the canal. When I came within some forty yards, it suddenly sprang into the water, and swam rapidly up stream for some distance ; then landed on a shelving part of the opposite bank ; scrambled up the side ; stood a few moments on top to look round ; shook the water off its flanks and then bolted off into a sandy waste beyond. It was a full-grown buck. I think he must have previously swam across the canal to feed on the short grass on the side I was moving. On this side, like the opposite, the country was perfectly open, so that if he disliked icy cold water, he could easily have avoided going into the canal to escape my approach. But he appeared to me to enter the water without the slightest hesitation, just as a Newfoundland dog would behave. A shikari who was with me, told me afterwards that the Gazelle constantly cross and re-cross the canal and its branches. In the part of the Hissar District I went over during a few days' stay, I noticed the Gazelle were nearly always seen not far from the canal and its irrigating channels, while what Antelope I came across, were miles away from water. The Gazelle appeared to keep near the gram fields ; and although these fields were protected all round by a high fence of thorny branches, they managed every now and then to jump over the fence, as on several occasions I saw them inside the fields. I was informed that when the hot weather sets in, the Antelope collect together and then keep near the canal and its water-courses.

G. S. RODON, MAJOR.

DHARWAR, *March* 1903.

No. XIII.—THE CRESTED GREBE.

It would appear that the Crested Grebe (*Podiceps cristatus*) is not at all uncommon in North-Eastern Assam. Messrs. Moore and N. S. Mondy have seen nearly a dozen this year and secured eight. Mr. Stevens of Rangagora has shot one and I have had several notices of its having been seen by others. On nearly all occasions the birds are seen in twos, not necessarily pairs, as frequently both birds prove to be males, and females are much less often seen than males.

E. C. STUART BAKER.

DIBRUGARH, ASSAM, *March* 1903.

No. XIV.—FOOD OF THE HAMADRYAD OR KING COBRA.

Referring to Vety.-Major G. H. Evans' paper on the Hamadryad in Vol. XIV, No. 3, of this Journal the following note regarding the food of this snake may be of interest :—

While touring in the Trans Salween Shan States in February 1900, I shot a hamadryad in the Mè Hang stream. One of my men hung it up on a tree close by. After watching its contortions for a few minutes—for it was not quite dead—I was greatly surprised to see what appeared to be 2 or 3 inches of the tail of a snake protrude from its jaws ; this I immediately laid hold of, and extracted what turned out to be a cobra—a light-coloured variety in excellent preservation so that it could not have been long swallowed. The lengths of the hamadryad and cobra in the flesh were, respectively, 9 feet 8 inches and 4 feet. I procured the skins of both.

W. H. CRADDOCK.

KUALA LIPIS, PAHANG.
(FEDERATED MALAY STATES), *January* 1903.

No. XV.—OCCURRENCE OF THE COTTON TEAL (*NETTAPUS COROMANDELIANUS*) IN SIND.

When shooting at a dhund near Sujawal last week I shot a Cotton Teal. I see Oates in his " Game Birds of India " says that " this small duck has not yet been observed in Sind." My shikari said that he had seen the duck before, but that it was very seldom shot. The boatmen did not seem to know it. In case this may interest you I am sending the duck for identification.

J. W. PARRINGTON, LIEUT.,
47th Battery, R. F. A.

KARACHI, *January* 1903.

[NOTE.—There appears to be some doubt as to this teal occurring in Guzerat and Sind so that the above record is interesting. Blanford says in Vol. IV, Birds—Fauna of British India :—" In India this Teal is rare in Malabar, the Bombay Presidency and Kattyawar and wanting in the desert parts of Rajputana, in Sind and the Western Punjab." Oates in his " Manual of the Game Birds of India," Part II, says : " This small duck has not yet been observed in Kashmir, in Sind or in Cutch and probably these tracts lie outside its range." Stuart Baker in " Indian Ducks and their Allies," page 193, Vol. XI., of our Journal says : " In India proper it may be said to have its stronghold in Eastern Bengal, is still very common in Western Bengal and Assam, less so in the Eastern Punjab and Rajputana, especially so in the cold weather, and actually rare towards the West of the Empire. Barnes says that it is not found either in Guzerat or Sind, but it has been recorded from both places since his book was written." Mr. Stuart Baker unfortunately does not say where it was recorded, so the above note of Lieut. Parrington's is interesting. In reference to Guzerat, Mr. E. L. Barton, of Bombay, writes: "On referring to my game-book I find—

On 17th January 1897 at Pardi (Surat District) I shot 5 Cotton Teal.
„ 24th „ „ „ „ „ „ 1 „ „
„ 13th Feb. „ „ „ „ „ 9 „ „
„ 18th Dec. 1898 at Lohderia (Ahmedabad District) I shot 1 Cotton Teal.
„ 23rd „ „ „ Ahdura (Ahmedabad District) I shot 1 Cotton Teal.

I have shot, I am certain, many more Cotton Teal both in Guzerat and near Bulsar in previous years, but in my diaries then they were only put down as duck or teal."—Ed.]

No. XVI.—FOOD OF *MELURSUS URSINUS* (THE SLOTH-BEAR OR INDIAN BEAR).

On the 6th March 1903 I wounded a bear which made off leaving a fresh blood trail. On following the trail fresh droppings were found and among them an entire snake skin about 15 in. long. The process of digestion had rendered identification impossible, and the scales were rubbed off, but the shape of the head was like that of a Russell's viper (*Vipera russellii*).

H. R. G. HASTED.

Vizagapatam Dist., 7*th March* 1903.

No. XVII.—*FELIS BENGALENSIS* (THE LEOPARD CAT).

About this cat Blanford remarks that there is one skin from the Coromandel Coast in the Calcutta Museum and a live specimen from Jeypore (Madras Presidency) was in the London Zoological Garden. From this it would appear to be rather uncommon in the northern parts of the Madras Presidency and I think it interesting to note that on 21st January 1903 one was killed in a beat in Jeypur State, Vizagapatam District, and that on 1st March one was caught in Jeypur District. The skin and living animal I have with me at present.

H. R. G. HASTED.

Vizagapatam Dist., 7*th March* 1903.

No. XVIII.—NOTES ON BIRDS NEAR QUETTA.

I notice amongst the Miscellaneous Notes in No. 3, Vol. XIV of our Journal, some notes on birds seen near Quetta, and would like to add a few that were obtained by me at or near Chaman in 1900 and 1901—

Aëdon familiaris,—The Grey-backed Warbler. In August and September in a garden and also near Sanzal.

Sylvia nana,—THE DESERT WARBLER. In the fort hills near Sanzal.

Scotocerea inquieta,—THE STREAKED SCRUB-WARBLER. Very common in the low scrub on the desert round Chaman.

Lanius assimilis,—THE ALLIED GREY SHRIKE. One specimen shot near Sanzal.

Oriolus kundoo,—THE INDIAN ORIOLE. Common in gardens. Mostly immature specimens seen.

Sturnus porphyronotus,—THE CENTRAL ASIAN STARLING. In Chaman in flocks in December.

Saxicola chrysopygia,—THE RED-TAILED CHAT. One specimen shot at Bogra in September.

Tharrhaleus Jerdoni,—JERDON'S ACCENTOR. At Chaman and at Saranan in January and March; at the latter place in small flocks in the bushes in the tanks.

Rhodospiza obsoleta (Licht). In Chaman in flocks in the gardens, in August and September and again in March, sometimes 20 or 30 at a time on railings and telegraph wires.

Passer hispaniolensis.—THE SPANISH SPARROW. In large flocks in gardens, &c., in October, November and December.

Emberiza schœniclus,—THE REED-BUNTING. Chaman, December.

Emberiza Stracheyi,—THE EASTERN MEADOW-BUNTING. One specimen obtained in Chaman in November.

Motacilla personata,—THE MASKED WAGTAIL. Fairly common in Chaman in the winter.

Anthus spinoletta,—THE WATER PIPIT. Common in lucerne beds at Chaman in winter.

Melanocorypha maxima,—THE LONG-BILLED CALANDRA LARK. On the desert in the winter. I kept one as a pet for some time which had hurt itself on the telegraph wires.

J. W. WATSON,
CAPTAIN, I.M.S.

POONA, *March*, 1903.

No. XIX.—NOTE ON *HIERAËTUS FASCIATUS.*

A pair of these birds visited our poultry yard for some months and accounted for 30 out of 40 (Bushire) chickens. I had long decided to shoot them, but their visits being at short intervals—sometimes in the forenoon, sometimes the afternoon—we were always taken unawares, and it was only when a commotion among the poultry announcing that another chick had been added to their list of victims, that we knew of their presence in the neighbourhood. Being shy birds, after securing their prey they were off as fast as wings could bear them and I only got an occasional glimpse at them as they were flying away, and concluded they were *Falco communis*, which are to be seen here occasionally.

A servant, who had seen the birds carry off a chick, when mentioning the circumstances, stated the birds first sat on the ground a short distance from the hen with her brood, then made a sudden dash for a chick and carried it off. This trait being unusual for *Falco communis*, I asked whether the birds did not swoop down and strike the chicks; he said, no, they first sat on the ground and then attacked the chicks.

On the morning of the 6th January, I personally saw the birds attack a brood, which were under a clump of trees about 50 yards from me; both birds came to the ground first, then dashed in among the chicks, one of them being successful in securing a chicken, and though I ran forward shouting, it was not till I was about 15 yards from them that they flew off, settling on the ground again in the next field. I got my fowling-piece and went after them, but they would not now allow me within range, flying off and settling on the ground about 100 yards further off. After a careful stalk I got a long shot at the one with the chicken as it was flying away, causing it to drop its quarry. Both birds then made off for the hills close by. I went after them taking a Martini-Henry rifle, and as anticipated, the birds would not allow me within 200 yards, but flew from peak to peak of the cliffs. A lucky shot at 200 yards, with the rifle, broke the leg of one of the birds, it flew about 300 yards, settling on the ground behind a boulder, while its mate kept hovering near it. My servant fired at the latter as it flew over our heads, but missed. The report caused the wounded bird to fly off another 200 yards, coming to the ground again, when a tawny-coloured eagle gave it chase and caught it on the ground in its talons. The eagle pecked at the wounded bird two or three times, but was more intent on watching our movements. Hoping to secure both birds, I sent my servant forward to shoot them; but before he could get within range, both birds flew away, the wounded one settling again about 100 yards off and the tawny eagle kept hovering over it. My servant managed to shoot the wounded bird, which I recognised as "*fasciatus*." On dissection I removed two eggs, each about one inch in diameter. The bullet, with which the bird had at first been wounded, had apparently first struck the ground and then the bird, for only a part of it was found embedded in the hollow of the pelvis behind the femur. The pelvis itself was not injured, but the femur was shattered one inch below the joint.

This turned out to be the one which had secured the chick, for embedded in its toes were feathers from the chicken, which had been driven in by the shot when I first shot at the bird as it was carrying away the chicken.

This eagle was in fine condition weighing nearly six pounds, but her crop was empty. This together with the great cold had no doubt sharpened the birds' appetites, and hunger had made them less shy.

W. D. CUMMING.

ORMARA, MEKRAN COAST, *January*, 1903.

No. XX.—PREHISTORIC-MAN-HUNTING IN INDIA.

Not long ago Lord Kelvin in a lecture entitled *The Age of the Earth* gave the reasons which point to the period of time which has elapsed since *organic* life first appeared on the earth as lying between twenty and thirty millions of years. Man, gradually evolved from tree-living ancestors, appeared comparatively recently upon the scene.

It has been shown in several ways that man existed during and before the last Glacial Period in Europe, by the association in many cases of his handiwork with the remains of extinct animals such as the woolly rhinoceros and mammoth which existed at that time as far south as the south of France, also by the occurrence of his weapons in the gravel drift in France and England at considerable depths, that gravel being now not in a river bed but in many cases at the tops of hills, showing that since that period the present valley has been formed—as for instance that of the river Thames in England and the Somme in France.

There is also the evidence as to age obtained from caverns in both countries, in which the implements were sealed up by silt, and the familiar stalagmite formation, which is deposited at a more or less fixed rate.

The date of the latest of the many Glacial Periods can be roughly arrived at not only astronomically by the alteration in the position of the earth's axis, but also geologically, and thirdly from the examination of the deposits in caverns, as for instance Kent's Cavern at Torquay between 1825 and 1841, by Mr. Godwin Austen in 1840, and six years later by the Torquay Natural History Society. But the final examination extended over twelve years and was supervised by a Committee of the British Association between 1868 and 1880. All three methods of computation are substantially in agreement. The implements in Kent's Cavern most resembling the Indian ones (which I have had the honour of discovering and presenting to the Bombay Natural History Society) are those in the lowest stratum of all known as the Breccia, a dark-red sandy earth holding quartz nodules, and not at all unlike the lateritic deposits in which the Indian implements are always embedded or out of which they are derived.

Very briefly this is the order of the Kent's Cavern Strata from the top :

(1) Blocks of limestone up to 100 tons.

(2) The *Black Mould* up to 1 foot in thickness.

(3) Stalagmite floor of granular texture up to five feet in thickness and containing limestone blocks.

(4) The Black Band up to 4 inches.

(5) The Cave Earth—a red clay less than 4 feet thick and in some parts absent.

(6) A stalagmite floor up to 12 feet thick.

(7) The Breccia.

By various methods of computation it seems that as long ago as 250,000 years man flourished in Europe, and therefore probably long before.

When I made my discoveries in Somaliland, during thirteen expeditions to that country, of stone implements at Jalelo on the Issutugan, of exquisite workmanship and in considerable numbers (three rather poor examples of which are all I have been able to offer to the Society) and *the first ever found in Africa,* Sir J. Evans, the Treasurer of the Royal Society, in a communication to that body at once claimed them as paleolithic and as completing the chain of evidence linking India with Europe in prehistoric times. The types were *identically the same all* over the world. So much, then, as regards the age of Indian paleolithic implements. Of what kind were the men who used them? At the present day there are, I believe, no scientific men of eminence or at any rate hardly any, who do not accept the theories first propounded by Charles Darwin as clearly proved by overwhelming evidence all pointing one way. Man has *ascended* from the same root or arboreal ancestor as the anthropoid apes. His superior brain has given him the mastery, and given an upright position and the use of his hands, everything else has been shown necessarily to follow.

It is to be hoped that in India some caves may be found containing the remains of extinct animals, amongst which stone implements may be looked for, such as the caves at Bruniquel (Tarn et Garonne) and La Madelaine (Dordogne) in France; and those at Plymouth, at Brixham and in Yorkshire. We have not forgotten the recent discovery by M. Dubois in Java of part of the *cranium* and *femur* of an ape-like man or man-like ape (scientific opinion is divided as to what to call it) in Pleistocene deposits—named *Pithecanthropus erectus ;* it was thought that the earliest discovered examples of the skull of prehistoric man were merely deformities and that their ape-like character was accidental.

Repetition has rendered this impossible. When the Neanderthal specimen was discovered not far from Dusseldorf in Rhenish Prussia its extraordinary appearance led some eminent scientists at first to regard it as a deformed specimen, until the subsequent discoveries in the caves of Eguisheim (near Colmar, Alsace), at Brüx (Bohemia) and at Spy (Namur, Belgium) and so on. A specimen was found as long ago as 1700 at Canustedt (Würtemburg).

That the Indian specimens which I have presented to the Bombay Natural History Society are at least as old as the lateritic beds in which they occur, is shown by the condition of the chipped surfaces which are stained in exactly the same way as the unworked quartsite boulders in the same bed. Some have been waterworn previous to becoming embedded and some washed out and waterworn afterwards.

H. W. SETON-KARR.

WIMBLEDON, LONDON, S. W.,
February, 1903.

No. XXI.—DROUGHT-RESISTING FODDER PLANTS FOR INDIA.

In view of the importance of this subject and the immense benefit which will result to India if some good drought-resisting fodder plants are introduced, the following note by Sir W. Wedderburn will be read with interest. *Atriplex semibaccata* appears to have proved to be a most successful fodder-plant in California in places where the normal rainfall is small, and it is possible that in some parts of India, where similar conditions prevail, the cultivation of this plant will be found to succeed.

EDITORS.

DROUGHT-RESISTING FODDER PLANTS.

No. 2.

ATRIPLEX SEMIBACCATA ON ALKALI LANDS.

EXPERIMENTS IN INDIA.

The India Office has been so good as to supply me with the most recent information from India regarding fodder for cattle in times of drought. This information is contained in a Note (Agricultural Ledger No. 13 of 1901) by Mr. Moreland, Director of Agriculture, reviewing the attempts made to utilise the "reh" or "usar" lands, amounting to some two million acres, in the North-West Provinces and Oudh. The first important correspondence on the subject was published in 1864, No. 42, Government Selections, and deals with the deterioration of villages lying along the Western Jumna Canal. It shows that the construction of that canal, and the neglect of drainage works, led to the accumulation of injurious salts at the surface in such quantities as to destroy the fertility of the land, and render cultivation impossible. There is no record of attempts made to meet this mischief during the next ten years; but in 1874 the matter was taken up by Mr. (now Sir Edward) Buck, and in 1876 the "Reh Committee" was appointed, and a scheme of experimental work was drawn up, to include arboriculture, surface and subsoil drainage, flushing, manuring, and the growth of special crops. Unfortunately no chemical analysis appears to have been made of the soil selected for these operations; and the omission of this essential preliminary deprived the experiments of scientific value; while it led to action being taken in wrong directions as, for example, when nitrates and phosphates were applied to the "usar" lands, which are now known to be already charged (even to excess) with these nutrients.

2. The Reh Committee's experiments, directed to the reclamation of "usar," are reported under four headings: (1) Removal of salts; (2) Drainage; (3) Silting; and (4) Deep cultivation, manuring, and ploughing in green crops. (1) *Removal of salts.* This was tried on the Awa estate. The salts on the surface were scraped off before the rainy season, and in the following year the quantity of such salts was found to be decidedly less; but the subsequent history of this plot cannot be ascertained. (2) *Drainage.* Surface drainage was attempted, but the plants died, and this method was given up as a failure. Subsoil drainage with two-inch pipes was then tried, but was also held to be a failure, mainly on account of the prohibitive cost, and the experiment was abandoned. (3) *Silting.* By this method it was sought to form an entirely new soil by deposit on the top of the "usar," but it was found that this process was of very limited application, depending as it did upon a copious

flow of water, and a sufficient supply of coarse silt. (4) *Deep cultivation, manuring, and ploughing in green crops.* Some practical success was obtained in improving the texture of the soil and in dispersing the salts from the surface by growing green crops of rice and hemp, and ploughing them in; but the experiments do not seem to have been conducted on systematic or scientific lines. No analyst being available, the original condition of the plots was not known; and the ultimate results are not ascertainable, as, after some years of varied operations, the plots were either sold to private individuals or diverted to other purposes. Thus at Amraman, acquired in 1882, there was abundant ploughing and manuring; rice, barley, peas, maize, and millet were sown with varying success; but in 1892 the whole reserve was sold, and the improvement effected in the condition of the soil appears to have been lost. Similarly at Cherat there was no analysis to begin with, and the official reports differ as to the nature of the saline deposits. Eventually this reserve was sold to a Mr. Keventer, who utilised it as a dairy farm. At Gursikran and Juhi the operations took a different direction, and a quantity of hay was made from the natural grasses belonging to "usar" soil, principally the *Sporobolus arabicus.* The areas were enclosed, and the grasses grew in considerable abundance; but they died down after the rains; they did not stand drought; and the hay, which proved unpalatable and innutritious, was refused both by the Cavalry and Commissariat Department as being unfit for fodder. The unsuccessful attempts to introduce Australian salt-bushes as fodder plants are referred to by Mr. Moreland at page 453 of the Agricultural Ledger. The first trial was made in 1882, and the *Atriplex nummularia* promised to do well. But the beginning thus made was not effectively followed up, and the ultimate fact of the experiment is recorded as follows: "Unfortunately the further detailed history of these plants is not on record, but all have disappeared." Mr. Moreland adds that he has learned from Mr. Duthie, Botanical Director, that the failure of these plants was "due to their inability to live through the wet season when the surface of the 'usar' is slimy mud, and water often stands on it." This collapse of the experiment shows that in selecting the locality for plantation, due consideration was not given to the special characteristics of the salt-bush, which tolerates extreme heat and drought, but cannot endure heavy rain and a moist atmosphere. Owing to this unhappy error a great opportunity was lost. Judiciously planted on the arid waste, which is its proper habitat, the salt-bush might, in the droughts of 1897 and 1900, have proved the salvation of countless plough cattle, besides, as will presently be shown, solving the problem of "usar" reclamation.

3. From the above summary it appears that as yet but little progress has been made, either in propagating drought-resisting fodder-plants, or in reclaiming "usar" lands, "the problem which has been the subject of special study by the Agricultural Department for the last twenty years" (Agricultural Ledger, p. 415). From want of scientific method the Department

appears to have missed the clue to success which has been dextrously grasped by the experts in America. To use a homely phrase, two birds may in the present case be killed with one stone, for American research shows that by the propagation of salt-bush on dry alkaline waste a double benefit can be secured. On the one hand an abundant supply of nutritious fodder may be provided; while, on the other hand, the noxious salts will be removed, thus restoring the soil to fertility, and rendering it fit for canal irrigation. In the interests of Indian famine prevention every effort should be made to secure this double advantage. How this may be done can best be learned by reference to the facts ascertained by American experts, to which I will now refer.

American Research.

4. On the suggestion of the Director of the Scientific and Technical Department at the Imperial Institute, I addressed the United States Agricultural Department at Washington, and by their courtesy have received the latest accounts of what has been done in America, as regards fodder plants on salt lands. Among the printed papers received are the following pamphlets, prepared at the Experiment Station of the Agricultural College and issued as Bulletins by the University of California :—

Bulletin No. 125—(May, 1899) : "Australian Salt-bushes, Results of 18 years' tests : characteristics, propagation, and field tests," by Charles H. Shinn, Inspector of Stations ; and "Composition and Food Value," by M. E. Jaffa, Assistant Chemist.

Bulletin No. 128—(March, 1900) : "Nature, Value, and Utilisation of Alkali Lands," by E. W. Hilgard, Director and Chemist.

Bulletin No. 133—(August, 1901): "Tolerance of Alkali by Various Cultures," by R. H. Loughridge, Agricultural Geologist and Physicist.

Bulletin No. 140—(February, 1902): "Lands of the Colorado Delta in the Salton Basin," by Frank T. Snow, E. W. Hilgard, and G. W. Shaw ; with a Supplement by J. Burtt Davy, Assistant Chemist.

I have also received 12 pamphlets on forage plants, published at Washington by the United States Agricultural Department. Of these the following bear the most directly on the subject of drought-resisting crops:—

Farmer's Bulletin No. 108—(1900) : "Salt-bushes," by P. Beveridge Kennedy, Assistant Agrostologist.

Circular No. 18—(1899): "Smooth Brome-grass," by F. Lawson-Scribner, Agrostologist.

Bulletin No. 2—(1900): "Fodder and Forage Plants," by Jared G. Smith, Assistant, Section of Seed and Plant Introduction.

5. No one can peruse these detailed records of chemical and botanical research without being impressed by the persistency and scientific skill with which the experiments have been carried out, and the care with which results have been recorded. Under the direction of public authority a staff of

highly-trained experts have set themselves to deal systematically with the problems arising out of drought; experimental farms and laboratories have been at their disposal; and the rich harvest of facts and experience reaped by them contrasts painfully with the meagre results obtained in India by the inadequate machinery provided for similar investigations. The conclusions arrived at, so far as they bear on the subject of this Note, may be briefly summarised under two headings: (A) Chemical analysis; and (B) Botanical research.

6. (A) *Chemical Analysis.* By this branch of inquiry it is shown that the salts existing in alkali lands are made up partly of salts that are noxious to plant life, *viz.*, carbonate of soda, sodium chlorid (table salt), and sulphate of soda (Glauber's salt), and partly of salts which are valuable fertilisers, *viz.*, sulphate of potash, phosphate of potash, and nitrate of potash: that these salts are originally distributed in solution throughout the soil; and that by means of capillary attraction and evaporation they are accumulated on the surface, forming a crust destructive to most forms of vegetable life. (B) *Botanical Research.* On the other hand, by the experiments in this department, it is proved that certain fodder plants, notably the Australian salt-bushes, can live and thrive upon such alkali lands, absorbing large quantities of the noxious salts, while appropriating only a small proportion of the fertilisers. They also possess the valuable property of sharing with the hygroscopic salts the 10 per cent. additional moisture held in suspense in these alkali soils. Among these salt-bushes experience points to *Atriplex semibaccata* as most suitable for hot dry climates, being drought-resisting, prolific, and capable of producing abundant supplies of good fodder; and it is found that by continuous cropping with this salt-bush the excess of injurious salts is eliminated; so that the alkali lands may, by this simple process, become "profusely and lastingly" fertile for the growth of ordinary crops.

7. With reference to the origin of the alkali trouble, Professor Hilgard points out (Bulletin No. 128, p. 13) that the soluble salts in alkali soil have, like the soil itself, been formed by the progressive weathering of the contiguous rocks; that the salts in the upper 4 or 5 feet of soil are usually limited in amount; and that they are not ordinarily replenished in indefinite quantities from the lower strata. The salts move up and down within the upper 4 or 5 feet of the soil or subsoil, following the movement of the moisture descending in the rainy season, or when irrigated, to the limit of the annual moistening as a maximum, and then re-ascending or not according as surface evaporation may demand. At the end of the dry season, in untilled irrigated land, practically the entire mass of salts may be within 6 or 8 inches of the surface. The injury to vegetation is caused mainly within a few inches of the surface, by the carbonate of soda, which corrodes the bark near the root-crown, and by the sodium chlorid, which acts as an antiseptic, and arrests development. Carbonate of soda may however be neutralised by treating it with gypsum, which converts it into the sulphate, or Glauber's salt, which

is comparatively innocuous. Sodium chlorid (table salt) cannot be chemically neutralised; but it can be removed mechanically, by scraping the salt crust from the surface, or by "leaching," that is by drenching the land with water, which dissolves the salts and carries them away by a system of under drainage. These methods however have the disadvantage that they carry off the fertilisers as well as the noxious salts. A special warning is given against the bad habit of surface irrigation, which stimulates evaporation and "deep-furrow" is recommended, *vide* diagrams at p. 38 of Bulletin No. 140. It is also pointed out that mere flooding will not wash away the salts, as these soak into the ground at the first touch.

8. The verdict arrived at from the botanical experiments is emphatically in favour of the *Atriplex semibaccata* within its own proper habitat. Summing up his conclusions Mr. C. H. Shinn, Inspector of Stations, reports as follows: "This Bulletin (No. 125) shows that the California Station has been experimenting with salt-bushes for 18 years, that the tests of some species have extended over the greater part of the State, and that *Atriplex semibaccata* is the most generally useful species of all that have been planted, although others are worthy of cultivation.........It is seldom that a plant shows so much adaptation to differing circumstances as *Atriplex semibaccata*." At the same time he warns us that "it cannot endure too heavy summer rains, nor the moist atmosphere of many warm countries," though "within its own realm it is unsurpassed among the gifts of nature to the deserts and alkali wastes which cover so large a part of the earth's surface." In this view he is fully confirmed by Professor Hilgard and the other authorities above referred to. I may quote a few particulars as to the special merits of this plant. First, as to its power of resisting drought: "The total rainfall at the Paso Robles Station for the season of 1897-98 was but 3·24 inches to March; April and May showers brought this to 4·75.........By the 1st of April, the roadsides were brown and barren. On unirrigated land there was no green fodder-plant excepting salt-bush in the entire region. The growth of *Atriplex semibaccata* on this poor and arid soil was a revelation to every farmer. Seed sown in December, 1897, made a foot of growth by April 12th, branching and covering the ground. After being cut back for sheep feed, it made a second growth of 6 inches by the end of May, and was cut a third time before the end of summer," (Bulletin No. 125, p. 5). Similar reports for the same dry year (1898) came from the other stations. Thus, in the West Sacramento Valley, "the salt-bush grew from a few inches to 3 feet in diameter on hard, dry clay land where even weeds did not grow; and it volunteered from self-sown seeds in the hard road." Then as regards tolerance of alkali, the *Atriplex semibaccata* stands "extremely high," surpassing all plants of similar food value in its power of growth on land highly charged with alkaline salts. It is also hardy in respect of cold, remaining green late in the season, and withstanding a temperature of 14° Fahrenheit. Further the *A. semibaccata* is very prolific, self-sown seedlings springing up

freely; the fallen seeds, and subsequent seedlings, being protected by the low-spreading mass of the plant. Some individual plants have, in California, attained a diameter of 18 feet in one year, much exceeding in growth the parent plants in Australia. A very large amount of fodder is thus produced, and in one case a yield is reported of 30 tons per acre of green forage. The green forage can be easily handled and made into hay, a special merit of this variety being that it is procumbent, and the stems are tender and flexible; whereas most of the other varieties of salt-bush being shrubby and erect, are only suitable for browsing. This hay has a high nutritive value, its protein content being twice that noted for wheat hay. Next to the salt-bushes the Chilean plant *Modiola decumbens*, of the mallow family, deserves attention as a means of removing salt from alkali land. It grows very freely, and is relished by cattle. Then there is the Tussock grass (*Sporobolus airoides*), which stock will eat; and the various alkali weeds, such as the "Grease woods" (*Samphires*), and the Alkali grass (*Distichlis spicata*). Smooth Brome grass (*Bromus inermis*) is also highly recommended in Circular No. 18. "Its drought-resisting qualities have proved it to be the most valuable grass for dry regions where other grasses could hardly exist." I observe also that the Argentine salt-bush (*Atriplex pamparum*) is favourably noticed.

PROPOSED INDIAN RESEARCH.

9. Such being, in brief, the result of American investigations, there remains the question: What practical steps should now be taken in order to utilise these conclusions, and obtain for India the two-fold benefit, of abundant fodder for cattle, and the reclamation of "usar" land? Before applying American experience to Indian requirements, care must be taken to ascertain how far the physical conditions of the two regions are identical; and for this purpose it is necessary that the tests of chemical analysis, and botanical experiment, should be applied in India with the same scientific accuracy that has been employed in America. It seems probable that the salts, both noxious and nutritive, contained in the "usar" soil are similar to those in the alkali lands of California. But in order to proceed with safety an exact analysis should be made in the different Indian Provinces interested. If by such analysis phosphates and nitrates are found to exist in abundance, it will be evident that experiments with artificial manures and night-soil may be at once abandoned; while the presence of carbonate will show that treatment with gypsum, or some analogous substance, is called for to neutralise the mischief to plant life. Then there is in India a wide field for botanic experiment, by reason of the varieties of soil and climate in the different provinces; and with the large choice of forage plants offered by the continents of Asia, America, and Australia, there should be no difficulty in ultimately discovering the forms of vegetation best suited to Indian requirements. *Atriplex semibaccata* should have a prominent place in these botanical experiments, care being taken to avoid past errors as regards its location

Had heed been given to the warning of American experts, these plants, so peculiarly suited to hot arid plains, would not have been exposed to the wet and mud which caused their destruction in the experiment at Aligarh. [*N.B.* In this connection I see it stated that Lowland Purslane (*Sesuvium*) and Saltwort (*Suæda*) are suited to moist alkali and salt-marsh soils.] It has been ascertained that the ash of the *Atriplex semibaccata* contains 40 per cent. of sodium chlorid ; and it is calculated that the removal from the land of a five-ton crop of this salt-bush hay will take away nearly a ton of salt per acre. It would therefore evidently be a great mistake to plough it in, as has been done in the case of rice and hemp, for this would have the effect of returning the noxious salts to the soil. Mr. Moreland states that a further trial is being made of certain salt-bushes and allied plants. It would be interesting to know the names of these, and I trust *Atriplex semibaccata* is among the number.

10. The extended investigation above suggested are probably beyond the resources of existing expert establishments in India, which have done their best with insufficient means. But the practical issues are so momentous, that we must hope the Government of India, seeing what has been accomplished in America will not hesitate to equip Experiment Stations and Agricultural Laboratories on a scale similar to those at Washington and in California. It would be well to obtain the co-operation of the Indian Universities and Technical Colleges in organising the operations ; and in order that the work may be conducted continuously and at moderate cost, a staff of young Indian scientists might be permanently enlisted, to be specially trained for these investigations. Professor Bose and others have shown what valuable results may thus be produced in the various departments of scientific research.

11. It is gratifying that the Secretary of State has expressed his interest in drought-resisting fodder-plants, and has moved the Government of India to cause the subject to be taken up earnestly by the Agricultural Departments in all Provinces. The prospect is encouraging ; for every "usar" acre that can be planted with salt-bush, will provide tons of wholesome sustenance for cattle, while gradually bringing into culturable condition waste lands which are described as being "intrinsically of the very richest description."

W. WEDDERBURN.

INDIAN FAMINE UNION,
Palace Chambers,
Westminster, S.W.

1st January 1903.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 5TH FEBRUARY 1903.

A meeting of the members of the Bombay Natural History Society was held at the Society's rooms on Thursday last, the 5th February 1903; the Venerable Archdeacon Scott presiding.

NEW MEMBERS.

The election of the following new members was announced :—

Mr. H. C. Nangle (Rangoon); Lieutenant A. Willock, R.I.M. (Bombay); Mr. St. G. de Carteret (Partabgarh, Oudh); Mr. P. J. Fitz Gibbon (Belgaum); The Hon'ble Syed Hoosein Belgrami, Nawab Imud-ul-Mulk Bahadoor, B.A. (Hyderabad, Deccan); Mr. A. D. St. C. Barr (Amraoti, Berars); Mr. T. J. Metcalfe (Rangoon); Lieutenant J. W. Parrington, R.A. (Karachi); Mr. J. Scott, M.I.C.E. (Calcutta); Mr. G. Richards, P.W.D. (Rangoon); Mr. J. McKenna, C.S. (Bassein, Burma); Mr. J. A Chapman (Bassein, Burma); Major C. T. Robinson, R.F.A. (Mhow, C.I.); Major S. D. Browne, R.H.A. (Mhow, C.I.); Dr. Nassarvanjee Fakirjee Surveyor, M.D. (Bombay); Captain P. C. Gabbett, I.M.S. (Coonoor); and Mr. Samuel Joyce (Bombay).

The Honorary Secretary, Mr. W. S. Millard, asked members to try and induce others to join the Society, as the more members they could obtain, the better would be the position of the funds of the Society, and more money could be spent in improving the Journal.

CONTRIBUTIONS.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting :—

CONTRIBUTION TO THE MUSEUM.

Contributions.	Description.	Contributors.
Some specimens of Fishes from the Persian Gulf.	......	Mr. F. W. Townsend.
1 Indian Pangolin or Scaly Ant Eater* (alive).	*Manis pentadactyla*............	Mr. A. H. A. Simcox, I.C.S.
1 Skin of the Indian Chevrotain or Mouse Deer.	*Tragulus meminna*	Mr. R. E. S. Branson.
1 Skin of the Cotton Teal ...	*Nettapus coromandelianus.*	Lt. J. W. Parrington, R.A.
1 Skin of the Great crested Grebe.	*Podiceps cristatus*............	Mr. H. Bulkley.
Three Stone Implements from the Madras Presidency.	....	Mr. H. Seton Karr, M.P.
1 Skin of the Eastern Little Stint.	*Tringa ruficollis*	Capt. H. H. Harrington.
1 Skin of the Little Ringed Plover.	*Ægialitis dubia*	
2 Skins of the Bengal Bush Lark.	*Mirafra assamica*..............	
1 Skin of the Indian Pipit..	*Anthus rufulus*.................	
1 Skin of the Eastern Baya.	*Ploceus megarhynchus*	
1 Skin of the Striated Weaver Bird.	*Ploceus manyar*	

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* Forwarded to the Victoria Gardens.

Contributions.	Description.	Contributors.
1 Skin of the Burmese Red Munia.	*Sporæginthus flavidiventris.*	Capt. H. H. Harrington.
2 Skins of the Pegu House Sparrow.	*Passer flaveolus*	
2 Skins of the Burmese Red-vented Bulbul.	*Molpastes burmanicus*	
1 Skin of the Burmese Shrike.	*Lanius colurioides*	
1 Skin of the Burmese Nuthatch.	*Sitta neglecta*	
2 Skins of the Burmese Spotted Babbler.	*Pellorneum subochraceum*...	
1 Common Snipe (albino).	*Gallinago cœlestis*	Capt. P. P. Kilkelly, I.M.S.

MINOR CONTRIBUTION.

From Mrs. A. K. Oliver.

CONTRIBUTION TO THE LIBRARY.

"The Butterflies of India, Burma and Ceylon," Vols. I, II, and III, by Marshall and de Nicéville.	Presented by Mr. C. Crommelin.

PAPERS READ.

The following papers were then read :—"On two Cetaceans from Travancore by H. S. Ferguson, with a Note on the same," by R. Lydekker, B.A., F.R.S., &c., in which a new porpoise or dolphin, named *Tursiops Fergusoni*, was described.

Mr. E. H. Aitken also read a paper on "The Butterflies of Bombay and the surrounding country" written by himself and Mr. E. Comber. The paper was made more interesting by specimens of the various butterflies being exhibited and referred to.

A vote of thanks was passed to the authors of the papers, and the meeting then terminated.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 5TH MARCH 1903.

The monthly meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 5th March 1903; His Excellency Lord Northcote presiding.

NEW MEMBERS.

The election of the following new members was announced :—

Mr. V. G. Morgan, I.F.S. (Hoshangabad, C.P.) ; Mr. H. H. Mann (Calcutta) ; Mr. J. E. C. Tukes, I.C.S. (Ahmedabad) ; Mr. E. H. Waterfield, I.C.S. (Kaira) ; Mr. J. T. Scotson, I.C.S. (Ahmedabad) ; Major R. H. G. Heygate, D.S.O. (Thayetmyo, Burma) ; Mr. W. M. Nuttall (Dibrugarh, Upper Assam) ; Mr. J. Malcolm Maclaren (Calcutta) ; Lieut. E. C. Coates (Ranikhet) ; Mr. R. H. Anderson (Dera Ismail Khan) ; Captain J. G. Hulbert, I.M.S., (Naini Tal U. P.); Captain G. C. Scott (Ceylon); Captain W. G. Liston, I.M.S. (Bombay); Colonel H. FitzGerald (Wellington, Madras); and Mr. John Glasser (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting :—

Contributions.	Description.	Contributors.
11 Fossils from the Gulf of Cambay.	....	Mr. R. P. Lambert, D.S.P.
1 Skin of the Blue-breasted Banded Rail.	*Hypotænidia striata*	Mr. S. L. Whymper.
1 quantity of Butterflies from Cannanore and Kodaikanal.	....	Capt. R. W. Burton.
2 Crested Buntings (alive)..	*Melophus melanicterus*	Mr. E. W. Harper, F.Z.S.
A quantity of Palæolithic implements from the Madras Presidency.	....	Mr. H. Seton-Karr.
1 Young Jackal (alive)	*Canis aureus*..........................	Mr. W. E. Turner (H.M.S. "Highflyer.")
1 Golden Tree Snake (alive).	*Chrysopelea ornata*............	Mr. A. M. Kinloch.
1 Green Tree Viper (alive)...	*Trimeresurus anamallensis*...	Do.
1 Snake	*Callophis trimaculatus*	Mr. R. H. Madan.
4 Red-billed Liothrix (alive)	*Liothrix lutea*	Mr. E. W. Harper, F.Z.S.
2 Silver-eared Mesias (alive)	*Mesia argentauris*	
2 Blue-winged Sivas (alive).	*Siva cyanuroptera*	
2 Black-crested Yellow Bulbuls (alive).	*Otocompsa flaviventris*	
2 White-eared Bulbuls (alive).	*Molpastes leucotis*	

Minor contributions from Mr. A. Forbes, Mr. F. A. Reddie, Colonel C. T. Peters, I.M.S. (Retired), and Major W. B. Bannerman, I.M.S.

CONTRIBUTIONS TO THE LIBRARY.

Moore's "Lepidoptera Indica," Vols. I, II, III, IV, and 5 parts of Vol. V. Presented by H. H. the Maharaja of Mysore.

"The Birds of Pekin," by Captain H. J. Walton, I.M.S., presented by the author.

"Journal of the Asiatic Society of Bengal," Vol. LXXI, Part II, No. 3, 1902, in exchange.

"On the Silver Pheasants of Burmah," by E. W. Oates, F.Z.S. Presented by the author.

"Text-book of Entomology" (Packard). Presented by Mr. J. F. Jowett.

THE ACCOUNTS FOR 1902.

Mr. N. C. Macleod, the Honorary Treasurer, placed before the meeting a statement of accounts for the year ending 31st December 1902, showing an income of Rs. 11,586; expenditure, Rs. 11,032; and a balance at credit of Rs. 1,562. He explained that the reason the income was smaller than previous years was due to a larger number of members having omitted to pay their subscriptions, and hoped that they would pay them without any further delay. It was resolved that the accounts be passed, subject to the usual audit.

PAPERS READ.

The following papers were then read and discussed:—1. "Fleas and the Plague," by Captain W. G. Liston, I.M.S., illustrated by a number of enlarged sketches, tables of experiments and microscopical specimens showing the human flea, the rat flea and a transverse section of a flea, containing the plague germs. 2. "Size of Remarkable Trees," by G. Marshall Woodrow. 3. "Food of Centipedes," by W. P. Okeden. 4. "Note on the breeding of certain Herons, etc., in Southern India," by Captain H. N. Packard, R.A. 5. "The Common Snakes of Bombay," by the Revd. F. Dreckmann, S.J., and W. S. Millard, which was illustrated by some excellent sketches made by Mr. P. Gerhardt showing the distinguishing features between poisonous and harmless snakes in which some similarity exists in colour, markings and general appearance.

Most of the papers will appear in full in the Society's Journal

PROCEEDINGS

OF THE MEETING HELD ON 16TH APRIL 1903.

The monthly meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 16th April 1903; Mr. J. Sanders Slater presiding.

NEW MEMBERS.

The Honorary Secretary, Mr. W. S. Millard, said it was gratifying to observe how members had responded to the appeal to obtain new members, and he was glad to announce that since the commencement of the year seventy-three new members had been elected. The committee sincerely hoped that members would not slacken their efforts, as it was desirable to obtain as many members as possible, and thus enable the Society to spend more money on the journal, especially as the coloured illustrations of Indian Ducks which are so much appreciated are so very expensive.

The election of the following new members was announced:—Lieutenant J. P. Stockley (Kherwara); Mr. R. Galloway (Secunderabad); Mr. A. H. Bell (Sirsa, Punjab); Mr. R. B. McCormack (Ghansur, Seoni Chappara); Mr. H. H. Hayden (Calcutta); Lieutenant C. T. Simcox (Lucknow); Mr. D. L. McCarrison (Koraput); Mr. W. Moore, F.J.C. (Dibrugarh, Assam); Mr. N. S. Mondy (Dibrugarh, Assam); Dr. Manilal G. Desai (Kaira); Major F. R. Ozzard, I.M.S. (Tongshan, N. China); Lieutenant F. Stanley Clarke (Tongshan, N. China); Mr. L. O. Clark, I.C.S. (Lushai Hills, Aijal, Assam); Lieutenant L. L. G. Thorpe, R.A.M.C. (Colaba); Colonel A. E. Ward (Kashmir); Mr. W. H. L. Cabell, B.A., I.C.S. (Rangoon); Dr. R. Row, M.D. (London), (Bombay); Major J. Manners Smith, V.C., C.I.E. (Neemuch, C.I.); Mrs. L. Dalrymple-Hay (Nellore, Madras); Mr. W. Raby Noble (Behali, P. O. Assam); Mr. A. J. R. Hope (Myitkyins, U. Burma); Mr. K. Bernhardt (Karachi); Lieutenant W. F. Maxwell, R.E. (Aden); Captain C. Hodgkinson (Lucknow) and Mr. W. J. F. Williamson (Bangkok).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting:—

Contribution.	Description.	Contributor.
Some Butterflies, mounted on plaster of Paris.	....	Mrs. K. Thomson.
1 Crested Bunting (alive)	*Melophus melanicterus*	Mr. E. W. Harper, F.Z.S.
1 Snake (alive) juv.	*Gongylophis conicus*	Mrs. C. Hudson.
1 Phursa (alive) juv.	*Echis carinata*	Do.
1 Eastern Purple Heron	*Ardea manilensis*	Mr. B. A. Gupte.
3 Argus Pheasants	*Argusianus argus*	Mr. R. Laird (through Mr. A. D. Neubronner).
1 Snake (alive)	*Polyodontophis subpunctatus*	Capt. N. S. H. Sitwell, R.A.
1 Small Indian Eagle	*Aquila hastata*	Mr. W. D. Cumming.
1 Noddy	*Anous stolidus*	Do.
1 Do.	*Do.*	Do.
1 Red-breasted Merganser	*Merganser serrator*	Do.
1 Indian Ring Dove	*Turtur risorius*	Do.
1 Sparrow Hawk	*Accipiter nisus*	Do.
1 Spotted Sand-grouse	*Pteroclurus senegallus*	Do.
1 Coronetted Sand-grouse	*Pterocles coronatus*	Do.
1 Grey-necked Bunting	*Emberiza Buchanani*	Do.
1 Bonellis Eagle	*Hieraetus fasciatus*	Do.
1 Indian Tawny Eagle	*Aquila vindhiana*	Capt. J. Watson, I.M.S.
1 Common Wood-Shrike	*Tephrodornis pondicerianus*	Do.
1 Indian Wren Warbler	*Prinia inornata*	Do.
The Ibis-bill	*Ibidorhynchus struthersi*	Mr. J. C. H. Mitchell.
1 Snake	....	Do.
2 Eggs of the Indian Spur-winged Plover.	*Hoplopterus ventralis*	Do.
2 Eggs of the small Swallow Plover.	*Glareola lactea*	Do.
A quantity of Marine shells and fossils from the Mekran Coast.	....	Mr. B. A. Gupte, F.Z.S.
1 Snake (alive)	*Oligodon subgriseus*	Mrs. C. Hudson.
1 Snake (alive)	*Typhlops brahminus*	Mr. S. F. Pearcey.
116 Birds' skins from the Shan States Frontier.	....	Capt. H. Wood, R.E.
1 Barn Owl or Screech Owl.	*Strix flammia*	Mr. T. B. Bell.
1 Nest of the Spotted-Grey Creeper.	*Salpornis spilonota*	Do.
1 Skull of the Indian Chevrotain or Mouse-deer.	*Tragulus meminna*	Major R. Hall, R.A.M.C.
1 White-cheeked Bulbul (alive).	*Molpastes leucogenys*	Mr. G. C. Rehling.
1 Houbara (alive)	*Houbara macqueeni*	Mr. W. C. Constable, R.I.M.

Minor contribution from Col. H. H. Barnet, R.E.

Contributions to the Library were received from H. H. the Maharajah of Mysore, Mr. E. H. Aitken, Mr. Edward B. Poulton, and Mr. G. Claridge.

EXHIBITS.

A splendid specimen of the Argus Pheasant (*Argusianus argus*) presented by Mr. Laird was exhibited by Mr. E. L. Barton, who had mounted it for the Society. It was greatly admired by all present and will prove a permanent ornament to the Museum. A vote of thanks was passed to Mr. Barton for his valuable work. Mr. E. L. Barton also exhibited a shooting seat which he had invented, and which was specially intended for duck shooting in places where there was a good deal of water, and in rushes at the edges of tanks, &c. The seat does not sink into mud, and as it revolves on a swivel it is of great use in duck driving, flighting, &c.

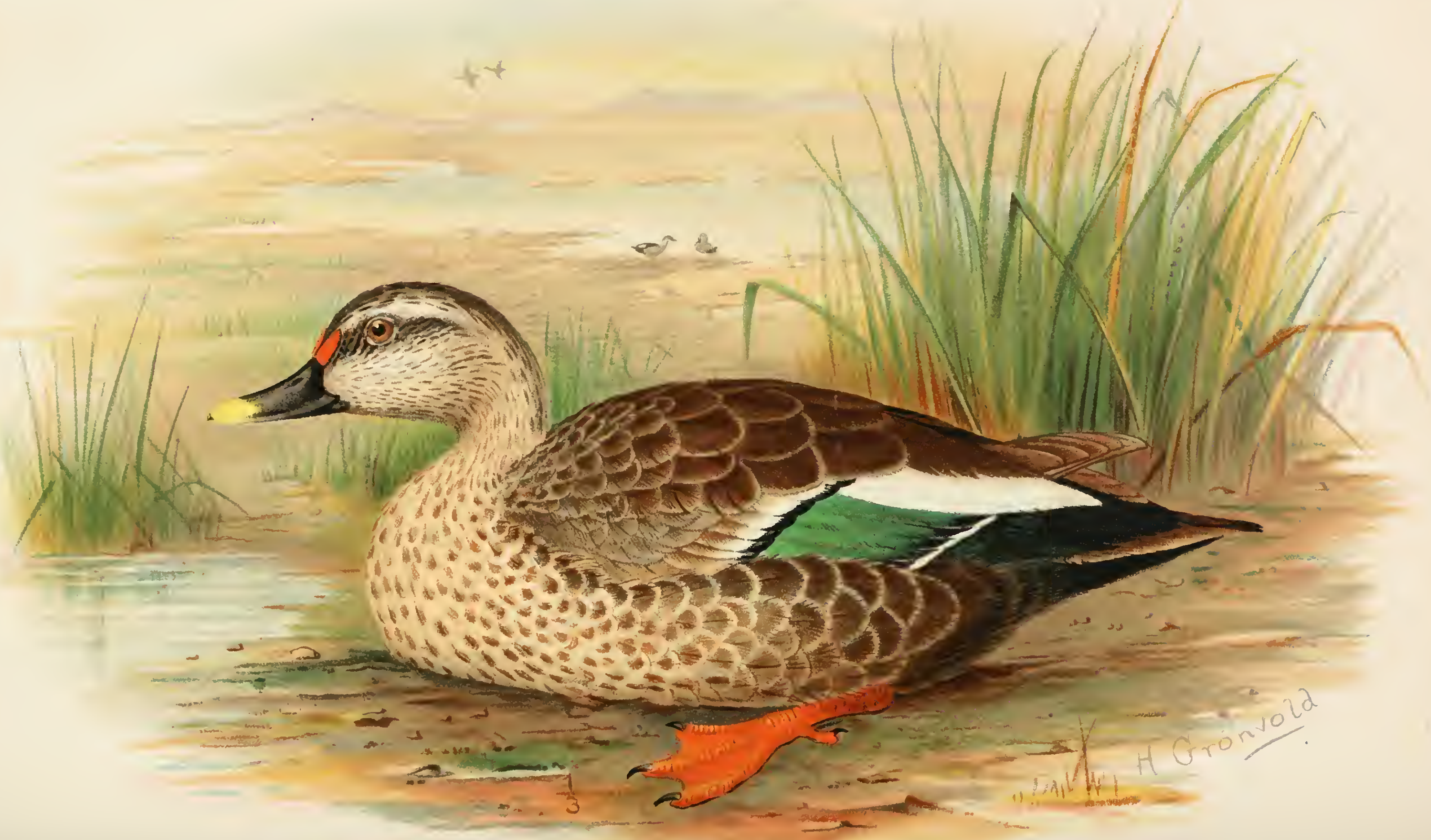
PAPER READ.

Mr. E. Comber read an interesting paper on "The Argus Pheasant" in which he referred to the curious habits of the bird and its wonderful plumage.

A COLLECTION OF MOSQUITOES.

Mr. E. H. Aitken said that it was proposed to make as complete a collection as possible of the mosquitoes of India, and the Committee hoped that members would help by sending them specimens of the kinds which paid them attention. The importance of a knowledge of the different species of mosquitoes could scarcely be exaggerated in the light of recent discoveries; but of the many medical men in India whom it concerned to know them, few had the opportunity or time to make large collections, and without a reference collection, identification was very difficult if not impossible. To make and keep such collection would be altogether in line with the honourable career of usefulness which has distinguished the Society in the past, and there could be no question that it ought to be commenced at once. Mr. Aitken then showed how mosquitoes were killed, pinned and preserved, and said if members were not disposed to take the trouble of performing the operation themselves they might send live mosquitoes to the Secretary in small bottles or glass tubes.

A vote of thanks was passed to Mr. Comber and Mr. Aitken, and the meeting then terminated.

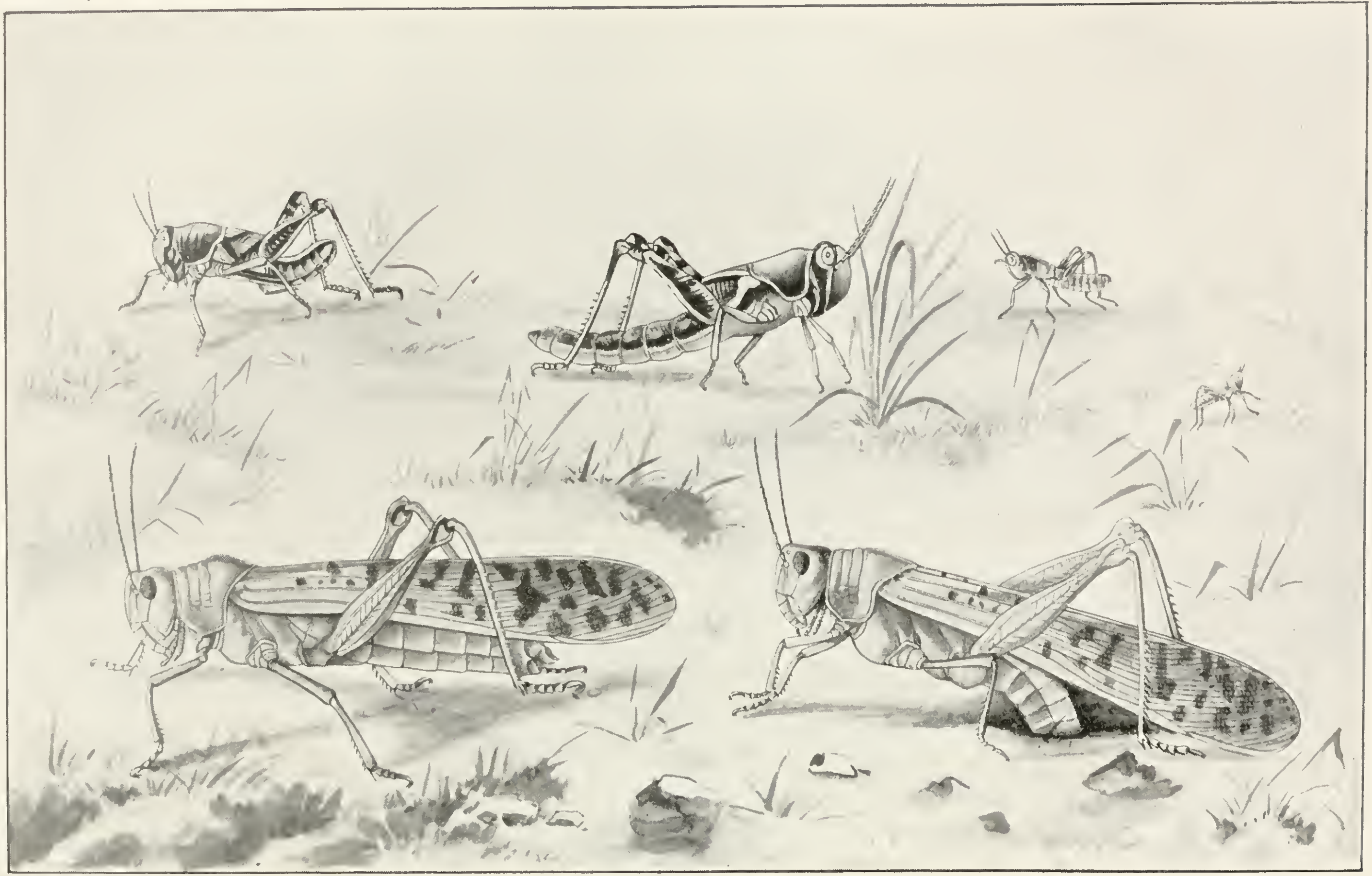


H Gronvold del

Mintern Bros Chromo-lith. London.

THE SPOT BILL OR GREY DUCK.

Anas pœcilorhyncha



A. Chowdhary, del.

Frontispiece.

ACRIDIUM PEREGRINUM, OLIV.—THE NORTH-WEST OR MIGRATORY LOCUST.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XV. BOMBAY. No. 2.

INSECT LIFE IN INDIA AND HOW TO STUDY IT,

BEING

A SIMPLE ACCOUNT OF THE MORE IMPORTANT FAMILIES OF INSECTS, WITH EXAMPLES OF THE DAMAGE THEY DO TO CROPS, TEA, COFFEE AND INDIGO CONCERNS, FRUIT, AND FOREST TREES IN INDIA

BY

E. P. STEBBING, F.L.S., F.E.S.

Introduction.

In a pamphlet* published as an Appendix to Volume XXVII of the *Indian Forester* (1901), I described, under the title of "A Note on the collection and preservation of entomological specimens, with a description of the methods to be employed in the study of life-histories of Insects," some simple apparatus necessary to the would-be student of the Insect World—whether his aim be that of the collector only or that of the investigator—whose desire is to make himself acquainted with the life-histories and habits of this exceedingly interesting class of the Animal Kingdom. I alluded shortly to the lines upon which this latter work should be taken up.

In a series of papers † entitled '*The Insect World in an Indian Forest*,' published in the *Indian Forester*, I have endeavoured to give in somewhat fuller detail some notes upon the great Orders and Families of

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* The pamphlet can be obtained from the Curator, Imperial Forest School, Dehra Dun.

† These papers are still appearing in the *Indian Forester*. The Introduction and Part I appeared in No. 9, Part I (continued), Part II in No. 11, and Part III, wrongly named, Part II in No. 12 of Vol. XXXVII, and Part IV (wrongly numbered Part III) in No. 1, Part V in No 2, Part V (continued) in No 3, Part VI in No. 4, Part VI (continued) in No. 5, Part VII in No. 6, Part VIII in No. 7 and Part IX (conclusion) in No. 8 of Vol. XXIX (1903). The Introductory portion and Part I are but slightly modified from what has already appeared in the *Indian Forester* Series.

Insects which will, I believe, prove useful to the student of Insect Life in the Indian Forest. The examples and life-histories quoted were more exclusively confined to Forest Insects.

The question of writing another series of papers dealing with this subject from a more general point of view had occurred to me, but I had thought of bringing out the material I had collected for the purpose in the form of a small book. The Honorary Secretary's request, asking for permission to reproduce the *Indian Forester* articles in this Journal, has led to the papers appearing here. Being the first series of illustrated papers dealing systematically with the subject of Indian Economic Entomology to appear, it is hoped that they may prove of service both to those interested in agricultural pursuits as well as to the collector, and he who would spend some pleasant hours in the study of some of Nature's most beautiful forms of life—a life scattered in such careless and bounteous profusion o'er the face of the earth.

For my illustrations of life-histories I shall endeavour to confine myself almost entirely to Insects of the Indian Region, whether of importance in the field, orchard, or forest, or the tea, coffee, and indigo concerns, &c., of the country. The forest pests will not of course be dealt with at the same length as in the forest series. Each of the Orders will be taken in turn, its characteristics considered, and the families containing species of Insects of economic importance dealt with as fully as is at present possible. Insects which are known to be or are considered likely to prove injurious will be alluded to at some length. Where possible remedies will be suggested.

But whilst thus endeavouring to help the novice the writer has another object in view, and that is to draw attention to and lay stress upon the various Families which his own experience has shown—we should perhaps say is showing—are likely to be of paramount importance in this country; until recently the information about them has been so meagre that it has been usual in European text-books to either make no reference to them at all, or merely a passing allusion to the fact that they are, relative to other better-known families, of small importance. Whilst this procedure is, of course, quite correct where the European student, who spends his life in Europe, is concerned, the case is rather different when the man so taught comes out to India and endeavours to apply his knowledge to the conditions around him in this country. He soon finds that the relative importance of many of the families he has studied must be re-arranged in his mind : those he has only touched upon or merely heard of must be given a prominent place in this re-arrangement, and old well-known friends relegated to the background as of comparatively small significance. I will not say that much can be accomplished upon these lines at present, but I trust to be able to aid the student to some extent in this direction.

Insect Life in the field or orchard, as elsewhere, may be divided into two great groups, in the first of which come the Insects actually injurious to plant growth and which are in consequence inimical to man ; in the second the predacious and parasitic Insects, which from their habits of preying upon their fellows may be considered as the friends of the human race. It should be noted that these latter are in their turn devoured by other Insects ; whilst fungi undoubtedly lend their help in keeping within bounds the enormous increase in numbers which would otherwise, and at times does, take place owing to the great fertility and prolificness of Insect Life.

In fact study and observation show that in all probability no Insect exists upon the face of the earth which has not enemies of one kind or another to contend with, which aid in keeping down its numbers. That this is as it should be becomes evident when it is remembered that Huxley calculated that the produce of a single Aphis (the green blight found on rose bushes, &c., are Aphids) would, in the course of ten generations, supposing all the individuals to survive, 'contain more ponderable substance than 500 millions of stout men, that is, more than the whole population of China.' The increase of this one family of insects is such that, were they not kept under, it has been calculated that in the course of two or three years they would, deriving their nutriment as they do directly from the plant in the growing state, leave no plant food available for other animals save that which might be derived from plants they did not attack. In other words, man would be very soon cleared off the face of the earth had not nature provided checks against undue increase of its Insect population. At times the preyed-upon obtain for a season the upper hand, and the alarming rate at which they then spread is known to all.

In conclusion, I may say that in these papers I do not propose to make use of more technical terms than are absolutely essential, whose explanation is to be found in any elementary text-book on Entomology. Explanations will be given in all cases where it is considered necessary. To the readers of this Journal no further apology is necessary for such technicalities as are unavoidable.

Chapter I.

The Position of the Class Insecta in the Animal Kingdom.

It will be at first necessary to consider shortly the position of the Insecta in the Animal Kingdom, and with this object in view the briefest of summaries of the Kingdom becomes essential.

Animals are primarily divided into the two great groups of the *Protozoa* or animals consisting of a single cell only (as, for instance, the *Amœba*) and the *Metazoa* or multicellular animals.

The latter are again sub-divided into the *Cœlentera*, or animals without a body cavity (such as the sponge, coral, jellyfish) and *Cœlomata*, or animals provided with a body cavity.

The *Cœlomata* comprise the rest of the Animal Kingdom and are divided into seven great Phyla, consisting of the *Platyhelminthes* or Flat Worms; *Nemathelminthes* or Round Worms; *Annelida* or Earth Worms, Sea Worms, and Leeches; *Arthropoda* or Prawns, Crabs, Spiders, Scorpions, Insects, Centipedes, Millipedes; *Echinoderma* comprising the Star Fish and Sea Urchins; *Mollusca* or Snails, Slugs, and Mussels; and lastly the *Vertebrata* or *Chordata*, comprising the Fishes, Frogs, Lizards, Birds and Mammals.

We thus see that the Insecta form one of the divisions of the great branch *Arthropoda* or segmented animals. They may be said to be segmented animals, having three pairs of legs and breathing by *tracheæ*, a system of air tubes ramifying through the body and opening on the sides of the insect by means of a row of breathing holes or stigmata; the genital openings of insects are near the posterior end of the body.

We shall consider the Insecta as divided into the following nine Orders:—*Aptera* (fish-insects); *Orthoptera* (cockroaches, mantis, locust, grasshopper, cricket, &c.); *Neuroptera* (white-ants, lace-winged flies ant lions, &c.); *Hymenoptera* (ichneumons, ants, bees, wasps, &c.); *Coleoptera* (beetles); *Lepidoptera* (butterflies and moths); *Diptera* (two-winged flies); *Thysanoptera;* and *Hemiptera* (tree bugs, cicadas, plant lice, and scale insects).

Some General Notes on Insect Life.*

It will be interesting to first glance briefly at some of the characteristic features of Insect Life in general. Insects form by far the largest part of the animals of the world; they outnumber in species all the other terrestrial animals together; whilst compared with the vertebrates their numbers are simply enormous. It is perhaps owing to their size that they have been so little studied as a Class and that so little is known as to the number of species at the present moment living upon the earth's surface and of the habits of the greater number of the known species. The largest Insects scarcely exceed in bulk a mouse amongst mammals or a wren amongst birds, while the smallest are almost or quite imperceptible to the naked eye, and yet the larger part of the Animal matter existing on the lands of the globe is probably contained in the forms of Insects.

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* To Dr. Sharp, F.R.S., in the Cambridge Natural History, Vols. V and VI, Insects, I am indebted for some of the following interesting notes on the very varied features of Insect Life.

In the waters of the globe the predominance of Insect Life disappears. They practically only exist in any numbers in small collections of fresh water, and then it may be for only a portion of their existence; of the larger bodies of fresh water they invade the fringes only, and they are almost absent from the oceans.

Insects may be said to be the most successful of all animals in the struggle for existence, and this is probably due to the rapidity of their growth owing to the peculiar relations which exist between the great functions of circulation and respiration, these being of such a nature as to enable the nutrition of the organs of the body to be carried on rapidly and efficiently so long as a certain bulk is not exceeded.

Rapidity of growth is in the case of some Insects very great and the powers of multiplication even greater still. In addition, by a process known as "metamorphosis," growth and development can be isolated from one another, thus allowing the former to go on unchecked and uncomplicated by the latter. It was probably in allusion to some of these favourable features of Insect Life and the remarkable rate at which they sometimes multiply that Linnæus made the statement,

Tres muscae consumunt cadaver equi, aeque cito ac leo,

not at all an improbable contingency, since it has been calculated that one female of the common house fly, *Musca domestica*, may have 25,000,000 descendants during one season.

I have said that by a process of metamorphosis growth and development are isolated from one another, and thus we get the different stages in the life of an Insect, known as the egg stage, the larval or grub stage, the pupal or resting stage, and the adult or imago stage.

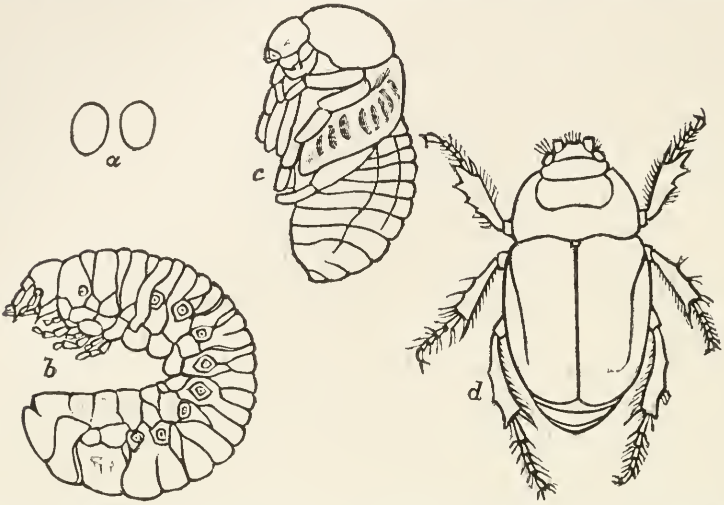

FIG. 1.—Stages in the life-history of a beetle (*Oryctes*). *a*, eggs; *b*, larva or grub; *c*, pupa or nymph; *d*, adult or imago.

(See fig. 1, a, b, c, d.) When all these four stages are present the metamorphosis is said to be 'complete.' During the second of these the Insect often eats voraciously and increases rapidly in bulk, development taking place at a later stage. The pupal stage is absent in some Orders of Insects, and the metamorphosis is then said to be 'incomplete.'

As is well known, some kinds of Insects form organised societies and live together in communities—a method of existence displayed by few other animals save man. We shall have occasion later to allude to some of the Insects living in this fashion when we consider the *Termitidæ* (the so-called white-ants), and the *Hymenoptera aculeata* (the bees, wasps, and ants). It will be unnecessary here to dilate upon the beauty of Insects. The beauty of the butterfly is proverbial, and those who seek will find it reproduced again and again in the numberless minute forms of the Insect World which perhaps compose the greater bulk of Insect Life in India (though we are still very far from being able to make definite statements on this subject as yet)—a world teeming with some of the most beautiful and certainly not the least interesting of created beings, and yet at present as little known as was America before the days of Columbus.

To commence the study of this life will not require hours of unproductive and wearisome search. The leaves of the nearest tree or shrub will be found to contain their quota of defoliators, be they the caterpillars of butterflies or moths (*Lepidoptera*), or the grubs of beetles belonging to the *Chrysomelidæ*, *Curculionidæ* (weevils), &c.; leaves and twigs will be found yielding up their sap to numbers of aphids or plant lice (*Aphidæ*) and scale insects (*Coccidæ*), &c.; their seeds will be riddled by the grubs of *Hymenoptera*, *Diptera* and weevils. If, intent on our study and with the wish to arrive at some definite reason for the death or sickliness of trees, we carefully examine the bark, it may be found riddled with pin holes. On stripping it off we shall drop into a perfectly new world of life below—a world which spends its existence beneath the bark and leaves its shelter in many instances but for a nuptial flight. Here we shall find a veritable Tower of Babel of Insect Life, consisting of genera of many different families, the individuals of which are present with very different objects. The particular families and genera present will depend greatly upon the condition of the tree we are examining. If still green but sickly and dying, or newly felled, various bark borers will be at work laying eggs in the best layer, the larvæ of which on developing will feed on the still fresh bark: *Buprestidæ*, *Curculionidæ*, *Cerambycidæ*, *Scolytidæ*, amongst the Coleoptera and various families of the wood-boring moths (*Heterocera*) may be present; other genera, some perhaps very minute, will be feeding upon the oozing sap; others again on the dying and drying bark; whilst numerous predacious Insects belonging to one or more of the great Orders *Orthoptera*, *Hymenoptera*, *Coleoptera*, *Diptera*, and *Hemiptera* will be found exhibiting an enormous variety of shapes and peculiarities, both in their larval, pupal and imago stages. Where all is new it would be invidious to particularize; but there will soon be little doubt in the minds of those who take up this study that the work of a lifetime would not suffice to become acquainted with the life-histories of one tithe of the predacious Insects which spend their existence beneath the bark of our Indian trees and shrubs or inside crop plants or hunting about outside for their prey, nor even to study them so far as to be able to say that such and such a larva becomes such and such a pupa and imago. The surprises in store for him who endeavours to grapple with this aspect of the work alone will perhaps do more than anything else to show him how little is at present known in India upon the subject of the life-histories and developments of some of her commonest insects, and how urgently recruits in this department of knowledge are required. Instances could be enumerated of insects which, if sought for in their abodes beneath the bark or in the roots, in the twigs or on the leaves, &c., are to be found almost as plentifully as the common house fly and throughout the same period in the year, and yet neither their eggs, larvæ nor pupæ are yet known.

Leaving the bark and cambium layer of older trees, we will now turn to young saplings and the smaller branches of the older trees. A search in this direction may show that grubs have gone into the interior of the stems and are boring their way up or down the centre. This will probably be the work of longicorn beetles or of the wood-boring moth larvæ. In the wood of older dead trees round shot holes or large oval galleries may be found riddling it through and through, the work of the wood-boring families of insects, the wood-wasps (*Sirex*) and boring beetles and their larvæ or boring moth caterpillars. Or on the branches again, white or variously coloured scaly masses may be visible, which, on a closer examination, are seen to be alive. These are scale insects (*Coccidæ*) sucking out the sap of the branch. Our search need not terminate here however. There still remain the roots of the tree, and to get at these it will be necessary to excavate the earth all round so as to leave them exposed in a pit where they can be examined satisfactorily. Here again we shall find many members of the Insect World. Aphids sucking out the sap, the very life of the young tree, bark-borers, wood-borers, and their attendant predacious and parasitic companions, sap-feeding beetles and dead bark eaters—some or all may be present, the individuals being probably of entirely different genera and species, if not families, to those working higher up in the trunk, main branches, twigs, or on the leaves and in the fruit and seeds of the tree. If we leave the tree and turn to the nearest field of crops, we shall find the same state of affairs. Leaves, stems, roots, flowers and seeds or fruits, all will be found to support, either externally or internally, their quota of Insect Life, some feeding upon the plant, others predacious upon the crop pest. If anything occurs to disturb Nature's balance of power, *e. g.*, if some particular crop plant or tree, &c., is grown in conterminous patches in fields or forests over large areas, given a favourable season to Insect Life the pest or pests partial to it may increase rapidly in enormous numbers, the food-supply and conditions being so favourable. In their turn the predacious and parasitic

Insect foes of the crop pest may increase in greater numbers when they find their food so plentiful, and in time they reduce the pest to its proper proportions again.

The above short notes will show that it is not difficult to *find* some of the homes of the Insect Life in India. The study of it will require careful observation and much patience, and whilst training the eye to observe, will develop the faculty of reasoning and working out results as well as, and one would think as usefully as, the most abstruse problem in mathematics.

Chapter II.

Structure of Insects.

Before proceeding to a consideration of the various Orders into which the class Insecta is divided, it will be necessary to consider shortly here the different parts of an insect. We have already seen that it may have four stages in its life,—the egg, larva or grub, pupa or nymph (chrysalis in butterflies, &c.) and the imago or adult insect (see Fig. 1, a, b, c, d). An adult Insect consists of three main divisions,—the head, the thorax, and the abdomen (Fig. 2). The head bears the mouth parts consisting of either a biting or sucking mouth or a combination of the two. These different forms will be shortly considered since they are of great importance, firstly, as being a feature by which Insects are classified;

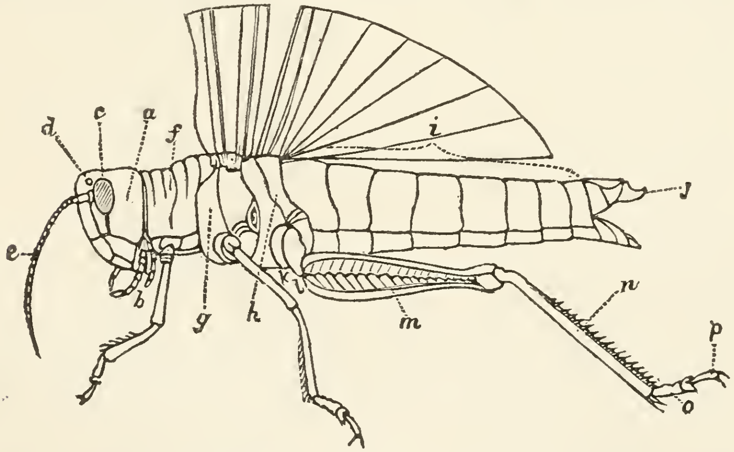

Fig. 2.—The North-West or Migratory Locust of India (*Acridium peregrinum*). *a*, head; *b*, mouth parts; *c*, compound eye; *d*, ocellus or simple eye; *e*, antenna; *f*, prothorax; *g*, mesothorax; *h*, metathorax; *i*, segments of abdomen; *j*, appendages; *k* to *p*, leg—*k*, coxa (hip); *l*, trochanter; *m*, femur (thigh); *n*, tibia (shank); *o*, tarsus; *p*, claw.

secondly, as on the kind of mouth parts present depends the nature of the damage Insects are able to commit, and the methods which can be employed to attack them. The biting mouth consists of an upper lip, the 'labrum,' which forms the front of the mouth and covers the base of the 'mandibles' or biting jaws. Below the mandibles we have a second pair of jaws or 'maxillæ' of more complicated structure and made up of a number of more or less well-marked pieces which vary considerably in form and shape according to the food and habits of the insect. Attached to each maxilla is a 'palpus' or feeler, which often has organs of sense. The mandibles cut and tear the food, the maxillæ break it up still further and then deliver it to the 'labium' or lower lip, which also helps in mixing the food. The labium closes the mouth opening beneath, forming its floor, so to speak. It is less complex than the maxilla, and it may consist of only a single piece or plate, but like the maxilla it is furnished with a pair of palpi or feelers. Fig. 3 shows two designs of a biting mouth. Insects provided with this form of biting mouth are always susceptible to being poisoned through their food, *i.e.*, they may be reached by poisons which will be taken internally. Of the sucking mouths there are several varieties functionally quite diverse and indicating differences of habit. In the butterfly and moth we have a flexible tube, coiled like a watch spring under the head between the labial palpi. Mandibles are absent and other parts aborted. This is used for sucking honey, &c., and therefore these insects are incapable of inflicting damage in this stage of their existence. A different form of sucking mouth is present in

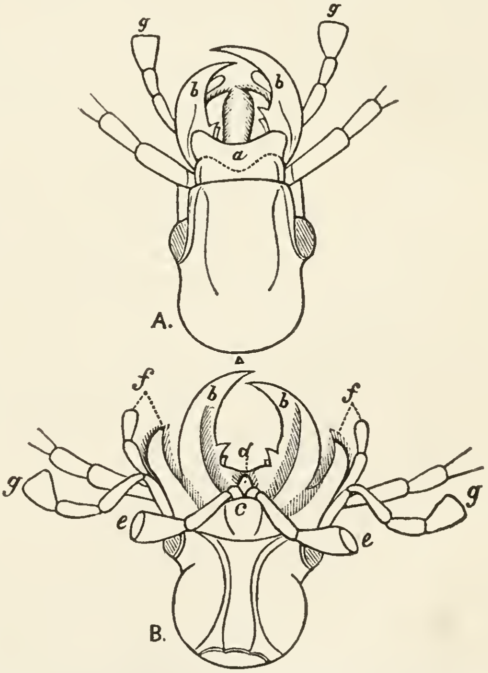

FIG. 3.—Head and mouth parts of a Ground Beetle (*Carabus*) enlarged. A, from above; B. from below. *a*, labrum; *b*, mandible; *f*, maxilla with palpi, *g*; *c*, labium with palp, *e*.

'the bugs' (Hemiptera). Here we have a jointed beak or rostrum, instead of the long tube, made up of four segments, inside which run four pointed lancets. This is used first for piercing plant structures, &c., and then for sucking up their juices. Insects with this form of mouth cannot be reached by internal poisons. The Flies (Diptera), have a modification of this form of mouth, the piercing organs being at times absent as in the house fly. Occasionally the mouth is both biting and sucking as in the bees, the mandibles being fully developed and the labium greatly elongated to enable the insects to gather the nectar upon which they feed. The head also bears the eyes, which may be compound, composed of a large number of facets, or simple (ocelli), and the antennæ, consisting of a number of joints (see Fig. 4). The thorax, which comes behind the head, is divided into three portions—the pro-thorax, bearing the first pair of legs, the meso-thorax, bearing the second pair of legs and the first pair of wings (if present), and the meta-thorax, bearing the third pair of legs and the second pair of wings (if present). Behind the thorax comes the abdomen, consisting usually of ten segments, though fewer may be visible, which are usually freely movable upon one another and never carry locomotion limbs. The extremity of the abdomen is, however, often furnished with appendages, which are primarily connected with reproduction, but which are often converted into weapons of offence and defence. Of such a nature are the ovipositors of Ichneumons, the stings of bees, wasps, &c. The leg is divided into several joints—the 'coxa,' the joint of attachment to the body, the 'trochanter,' a short joint following the coxa, the femur (or thigh), the tibia (or shank), and the tarsus, composed of a number of joints, from one to five in number; following the tarsus there may be a claw (see Fig. 2).

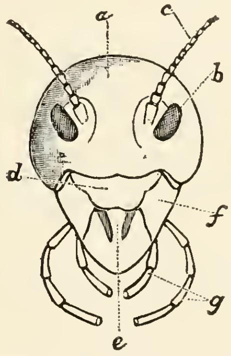

FIG. 4.—Front view of head of a cricket (*Brachytrupes achætinus*). *a*. epicranium; *b*, compound eye; *c*, antenna; *d*, clypeus; *e*, labrum; *f*, base of mandible; *g*, palpi.

Classification.

It has already been stated that insects are the most numerous in species and individuals of all land animals. It is estimated that somewhere about 255,000 species have been already described and this is probably but a tenth of those that really exist.

The class is divided into Orders, of which, following Dr. Sharp's[1] classification, we shall consider nine here. It will be seen that the classification of insects into the different Orders depends upon the nature of the wings and mouth parts present. The following are the Orders which will be considered in these papers, with a few of their chief characters :—

1. *Aptera* (ἀ without, πτερόν a wing—wingless[2] insects) ; mouth mandibulate (biting) or very imperfectly suctorial. Metamorphosis incomplete. Includes the so-called Fish-insects.
2. *Orthoptera* (ὀρθός straight, πτερόν a wing—straight-winged). Four wings are present, the front pair being coriaceous (leather-like) usually smaller than the other pair, which are of more delicate texture, and shut up in repose after the manner of a fan. Mouth mandibulate. Metamorphosis incomplete. (Includes earwigs, cockroaches, mantis, stick insects, locusts, grasshoppers, crickets.)
3. *Neuroptera* (νεῦρον nerve, πτερόν a wing—net-winged). Four wings of membranous consistency, frequently with much net-work in them ; the front pair very little, if at all, harder than the other pair ; the latter with but little or no fan-like action in closing. Mouth mandibulate. Metamorphosis incomplete. (Includes white ants, lace-winged flies, ant-lions.)
4. *Hymenoptera* (ὑμήν membrane, πτερόν a wing—joined-winged). Four wings of membranous consistency ; the front pair larger than the hind, which are always small and do not fold up in repose. Mouth mandibulate, sometimes provided also with a tubular proboscis. Metamorphosis complete. (Includes ichneumons, flies, ants, bees, wasps, &c.)
5. *Coleoptera* (κολεός sheath, πτερον a wing—sheath-winged). Four wings, the upper pair shell-like in consistency, and forming cases which meet together over the back in an accurate line of union so as to entirely lose a wing-like appearance, and to conceal the delicate membranous hind pair. Mouth mandibulate. Metamorphosis complete. (Beetles.)
6. *Lepidoptera* (λεπίς scale, πτερόν a wing—scale-winged). Four large wings, covered with scales. Mouth suctorial. Metamorphosis complete. (Butterflies and moths.)

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[1] Sharp Camb. Nat. Hist. Insects, Pt. I, p. 172 (Vol. V).

[2] It must not be supposed that all wingless insects fall within the limits of this Order.

7. *Diptera* (δὶς double, πτερον a wing—two-winged). Two membranous wings. Mouth suctorial, but varying greatly. Metamorphosis complete. (Two-winged flies such as house fly, mosquito, &c.)
8. *Thysanoptera* (θυσανος fringe, πτερόν a wing—fringe-winged). Four very narrow fringed wings. Mouth imperfectly suctorial. Metamorphosis incomplete.
9. *Hemiptera* (ἡμι half, πτερον a wing—half-winged). Four wings: the front pair either leather-like, with the upper portion more membranous, or entirely parchment-like or membranous. Mouth perfectly suctorial. Metamorphosis incomplete. (Includes tree bugs, cicadas, plant lice, scale insects.)

It must be remembered that numerous exceptions exist to these characters in most of the great Orders: for instance, wingless forms are by no means rare in several of the Orders.

Chapter III.

Order I. Aptera.

Small insects with a weak outer skin, destitute throughout life of wings, but with three pairs of legs; antennæ large or moderate in size. These are the most primitive forms of insects. The Order is mentioned here as it includes the Sub-Order Thysanura to which the common so-called fish-insect of India, a species of *Lepisma* (Family Lepismatidæ), belongs. Fig. 5 shows the common Calcutta insect. Most of the Thysanura are small, soft-bodied, with feebly developed mouth parts, and live in damp earth among decaying vegetable matter. Some live under the bark of dried and decaying trees or in decaying wood, and in rare instances species are found preferring dry and warm localities. Amongst the latter is the above-alluded to fish-insect. It is well known to all in India, and perhaps does most damage in libraries and to pictures. In the latter it apparently feeds upon the saccharine material used in mounting the picture in its frame. Such should either always be mixed with arsenic, or naphthaline powder should be dusted over the picture back. Book cases should be freely powdered with naphthaline to preserve the books. In the record-rooms of kutcherries, &c.,

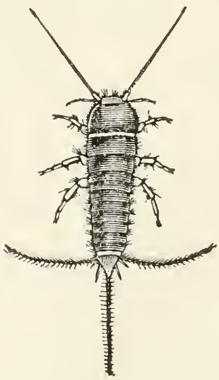

FIG. 5.—A Fish-insect. *Lepisma* sp. (Calcutta.)

throughout the country powdered naphthaline should be freely used, and at least a quarterly inspection made to renew it. In this way an incalculable amount of harm will be prevented and valuable records be safely preserved. Fish-insects are to be found as commonly in the sub-tropical regions of the country as in the sub-arctic ones. Whether the species varies is at present unknown.

Order II. Orthoptera.

The Orthoptera are Insects with mouth parts conspicuous and formed for biting; the four palpi (the small 'feelers' on either side of the mouth) very distinct, and the lower lip longitudinally divided in the middle. The upper wings (*tegmina*) are of parchment-like consistency, being closed in repose on the back of the insect so as to protect it. The lower wings are of more delicate consistency, large and furnished longitudinally with fan-like nervures (veins) and small cross ones which form together a network in the wing; they are generally covered over by the upper wings. The mode of growth of each individual is a gradual increase in size, the wings being developed during the last moult, *i.e.*, the metamorphosis is incomplete, as there is no pupal stage. Species exist in which the wings are absent or rudimentary. Fig. 6 shows an insect belonging to this Order, the common cockroach of India.

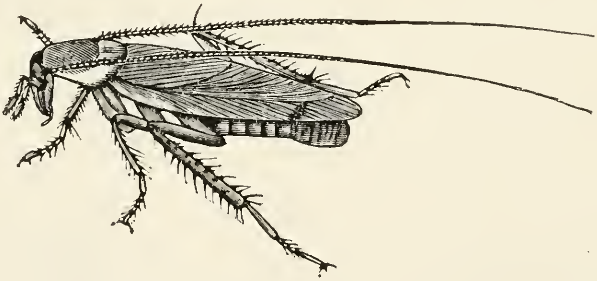

FIG. 6.—Common Indian Cockroach. *Periplaneta americana* (Calcutta) 1/1.

The Orthoptera are Insects of comparatively large size, the Order containing some of the largest known Insecta. It includes earwigs, cockroaches, praying insects or soothsayers, stick and leaf insects, grasshoppers, locusts and crickets.

The members of the Order often spend some time in the egg stage. After hatching they increase in size by moulting, the whole outer skin being shed at these periods. The wings are never present when the insect is first hatched, but appear subsequently and increase in size at the moults; the form and proportion of the segments of the body, especially of the thorax, undergo much change; changes in colour occur at the moults, and the integument becomes harder in the adult condition. The wings in many are absent, and flight appears to be of minor importance in the Order; in many cases, where the wings exist, they are purely musical organs and are not of any use for flight. The upper wings are never used for flight. The musical powers of the Orthoptera are confined to the Saltatoria group. The Cursoria are dumb or nearly so; in this latter series the wings have little value for flight, and are simply used for purposes of adornment or concealment, and more especially so in the Phasmidæ and Mantidæ (praying insects and stick insects). Here the upper wings frequently exhibit a great resemblance to vegetable structures, such as stems, leaves, &c., the veins and shape of the leaf being copied with remarkable accuracy in the wing of the insect. Contrary to the usual conditions amongst Insects, the female is often more remarkable in colouring than the male.

The eggs of the Orthoptera are deposited in capsules or cases; these capsules may contain only one egg or a great many (Figs. 9 and 12).

The number of existing species of the Order is estimated at 10,000, but this is probably far under the mark, as the small tropical forms have never been properly collected.

We shall, following Sharp, treat the Order as comprising seven families:—

Series *Cursoria.* Hind legs but little different from the others.

1. *Forficulidæ* (earwigs): upper wings short, lower wings complexly folded; body armed at the extremity with a strong forceps.
2. *Blattidæ* (cockroaches): coxæ of the legs large, exserted, protecting the lower part of the body.
3. *Mantidæ* (praying-insects): front legs very large, raptorial, armed with spines.
4. *Phasmidæ* (stick-insects): meso-thorax large as compared with the prothorax.

Series *Saltatoria.* Hind legs elongate, formed for leaping; their femora usually thickened.

5. *Acridiidæ* (locusts): antennæ short, not setaceous, of not more than 20 joints; tarsi three-jointed.
6. *Locustidæ* (grasshoppers): antennæ long, setaceous, composed of a large number of joints: tarsi four-jointed.
7. *Gryllidæ* (cricket): antennæ very long, setaceous; tarsi two or three-jointed.

Series Cursoria.

Hind legs resembling front ones.

Fam. I. Forficulidæ—Earwigs.

These Insects are distinguished by having a horizontal head and very short wing covers, *i.e.*, upper wings, which do not extend beyond the insertion of the hind legs and repose flat on the back, meeting together in a straight line along the middle. The lower wings are very complexly folded beneath the upper, projecting at the lower end in small slips from beneath them (see Fig. 7); when fully open they are seen to be earshaped. This formation of the wings is characteristic of the family when wings are present. The end of the body is furnished with a pair of large callipers.

This family is not of great economic importance as far as is at present known. Some species may, however, prove of service in preying upon noxious pests. Whilst visiting the sandalwood areas of North Coimbatore in Madras, the writer noticed that a large grey earwig, *Forficula* sp. (Fig. 7), was almost invariably present in the old galleries of a longicorn beetle, which bores into the stems of saplings and tunnels down their centres. These tunnels were also used as a home by a species of white ant (see Fig. 26), which was tunnelling through the wood of still living trees. The earwig was probably predacious upon the ants and their larvæ.

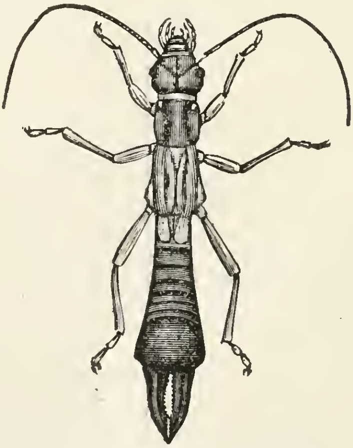

Fig. 7.—An Earwig. *Forficula* sp. (Coimbatore, Madras) $\frac{2}{1}$.

Fam. II. Blattidæ—Cockroaches.

These are one of the oldest forms of Insects known, for it is certain that in the carboniferous epoch they existed in considerable numbers and variety, and the remains found do not differ very essentially in appearance from present-day forms. The group contains about 800 species, divided into ten genera.

The head is bent downwards, so that the mouth is on the under part which is directed backwards. (See Fig. 6.) Antennæ are very long and flexible, bristle-like, and consisting of 75—90 joints; they are longer in the male than in the female. Their function is supposed to be that of smelling. The body is very flat, ending in small flat processes, the 'cerci' which are usually distinctly jointed. Long strong running legs, with large free coxæ and big femurs, are present. Fig. 8 shows a dorsal view of an Indian cockroach *Blatta* sp.

These Insects are common in houses, vessels employed in river and ocean traffic, &c. Their larvæ much resembling the adults, but without wings, are often to be found in rotten stumps of trees in the forests and elsewhere amongst refuse. As a family their food is of a very mixed nature. *Periplaneta americana* (Fig. 6) is a cockroach of worldwide distribution and very common in houses in India. It is perhaps the commonest Insect in Calcutta houses throughout the year. The so-called "black-beetle," so common in London houses and elsewhere in England, is a cockroach by name *Periplaneta orientalis.*

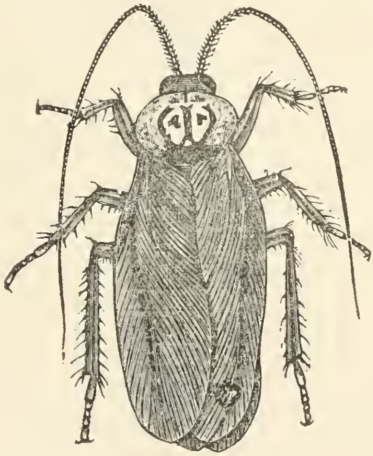

FIG. 8.—Blatta sp. (Johore) $\frac{1}{1}$.

Treatment.—Prepare a mixture of equal parts of finely powdered chocolate and borax and dust it into the crevices where the insects hide. The mixture must be well made so that with each part of chocolate, of which the cockroaches are very fond, they will get a particle of borax which is poisonous to them. The mixture is cheap and non-poisonous to man.

Fam. III. Mantidæ—Praying-Insects.

The Mantidæ are allied to the cockroaches, but differ in various respects. The body is, on the whole, more elongate, the prothorax being very long. The first pair of legs are prehensile, with large coxæ, strong femurs (thighs) provided with two rows of spines and tibiæ (shanks), also furnished with two rows of spines, which can be folded back upon the femurs; with these appendages the animal seizes its prey, which consists of other Insects. In the peculiar position of rest assumed by these Insects their fore-legs are held up in the attitude of prayer from whence they get their name of the 'praying mantis.' The ova are attached to plants in groups surrounded by a capsule. Fig. 9

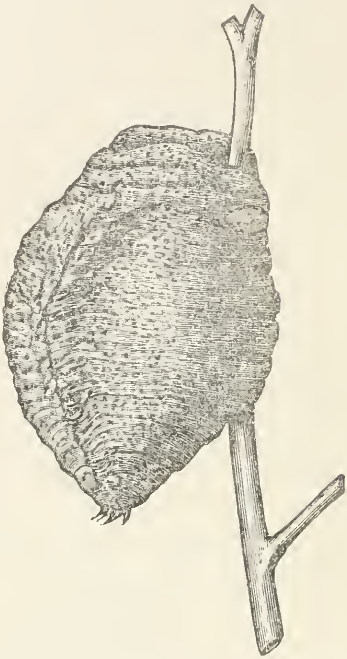

FIG. 9.—Egg-capsule of a praying mantis. *Deiphobe ocellata.* (Kulu.)

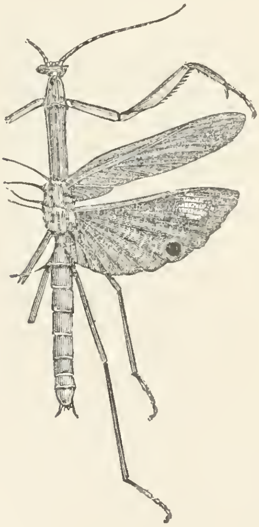

FIG. 10.—A praying mantis. *Deiphobe ocellata.* (Kulu.)

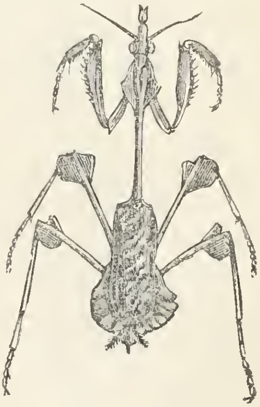

FIG 11.—A curious mimicking mantis. *Gongylus gongyloides.* (Eastern Bengal.) ½ nat. size.

shows an egg capsule of the mantis *Deiphobe ocellata* attached to a twig and Fig. 10 a male of this Insect (only the right half of the Insect is shown in the drawing) which comes from Kulu. The eggs last deposited are said to hatch first.

Many of the Insects of this family mimic the objects amongst which they live. In fact, so great is the variety of shape and external appearance of this group that de Saussure considers it a mimetic group. A mantis of Eastern Bengal called *Gongylus gongyloides* (Fig. 11) has its under surface resembling the pink corolla of a papilionaceous flower. It usually hangs head downwards amongst green foliage simulating a flower, and Insects flying to and settling upon it are seized and consumed. This Insect has been known to science for upwards of three centuries, and yet very little has been observed on the various stages of its life-history, a case well illustrating the remarks already made upon this subject.

The *Mantidæ* are not of great importance except perhaps on account of their voracious and predacious habits, they being probably exclusively Insect feeders. Little, however, is at present known in India as to the service they may be to man in this direction, nor do we know whether individual members of the family confine themselves to one species or genus, &c., of Insects or whether they prey indiscriminately upon a family, group, or even Order. *Mantidæ* are common enough, and are often attracted to the lighted bungalow or tent at night, and may be watched stalking their prey or waiting motionless on the table or white-washed walls until an unwary Insect walks or flies within reach. They feed upon their prey whilst still alive, tearing off the head and dismembering the Insect with a complete indifference to its struggles.

Fam. IV. Phasmidæ—Stick and Leaf-Insects.

The *Phasmidæ* are inhabitants of warm countries. They mimic dry sticks and leaves in a marvellous manner. The wings are rudimentary and legs very long. The prothorax is very short and the meso and meta-thorax unusually long, and it is by this character that the Insects can be easily distinguished. Their eggs have a remarkable resemblance to the seeds of plants. They are dropped singly by the Insect at random on the ground, being enclosed in a capsule. Fig. 12 shows two eggs of *Lonchodes virgens*, Westw., from Sibsagar, an insect nearly 18 inches in total length. Stick-insects have the power of renewing a lost leg, the mutilated limb being replaced

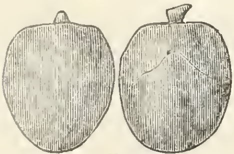

FIG. 12.—Eggs of a Stick-Insect. *Lonchodes virgens*. (Sibsagar, Assam.)

by one as perfectly functional as the original. The males and females often differ entirely in appearance.

The genus *Bacillus* is wingless, the elongate body and long legs looking like a dry branched twig or piece of stick. This genus feeds upon foliage, at times doing very considerable defoliation in Australia. The Insects are, however, very sensitive to cold, and frost will always put an end to them there. Fig. 13 shows an Indian species, *Bacillus artemis*, Westw., from the Naga Hills. In Fiji and the Friendly Islands a species of *Lopaphus* eats the leaves of the cocoanut, and at times causes such a scarcity of food that it becomes necessary to take measures to destroy them.

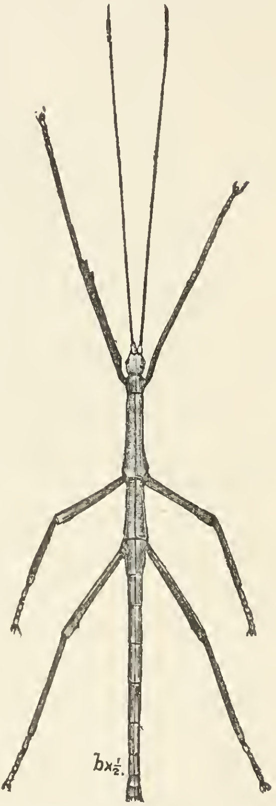

FIG. 13.—A Stick-Insect. *Bacillus artemis.* (Naga Hills, Assam.)

The genus *Phyllium* occurs in the tropical regions of the Old World. The upper wings in these Insects and often their legs and other parts are modified into leaf-like structures. A species of Phyllium, *Phyllium scythe*, is the Indian leaf-insect, whose broad abdomen and upper wings are exactly like a leaf, and the legs are flattened out and also resemble portions of leaves. It is fairly common in Eastern Bengal and Assam. Natives of India believe, and have volunteered the information to me on several occasions in Eastern Bengal, that the Insect is only a leaf, which developed as such originally and then *took to walking.* Its colouring changes with that of the leaves of the tree or shrub upon which it is found. Fig. 14 shows a female of this extremely curious Insect.

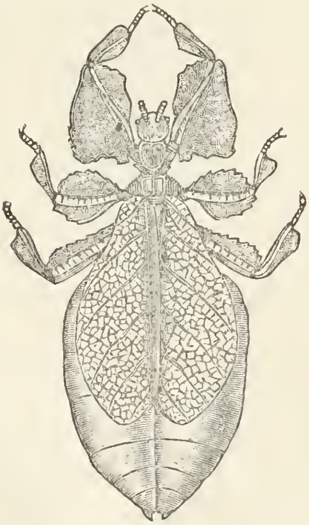

FIG. 14.—A Leaf-Insect. *Phyllium scythe.* (Eastern Bengal) $\frac{3}{4}$.

This family would appear to be well represented in Assam, most of the species in the Indian Museum collections coming from that locality. It would be most interesting if any one serving in that part of the continent would take up and work out this most curious, as it is interesting, family. He would be able to obtain help from the Indian Museum collections which, thanks to the intimate knowledge of the group possessed by the late Mr. Wood Mason, a former Superintendent of the Museum, are systematically arranged and contain a large number of species.

Series Saltatoria.

Hind legs elongate, formed for leaping; their femora usually thickened.

Fam. V. Acridiidæ—Locusts.

The hind legs differ from the others in being more elongate and in having their femora broader near the base. Antennæ short and thick, with less than 30 joints. There is no exserted ovipositor in the female. Tarsi are short with three distinct joints. The auditory organ is placed on the upper part of the side of the first abdominal segment. The large head is joined to the thorax in one piece, the front being deflexed downwards at a sharp angle. Besides the two compound eyes there are three ocelli (small simple eyes, see Fig. 2) present. The upper wings are roof-shaped.

This family is remarkable owing to the presence of air sacs in connection with the tracheæ in the interior of the Insect and it is doubtless the possession of these which enables them to undertake the great flights they perform when migrating.

The chirping sound of locusts is produced by rubbing together the outer face of the upper wing, one of the veins in which is prominent and possesses a sharp edge, and the inner face of the hind femur, which bears a series of small bead-like prominences placed on the upper of the two lower ridges which run along the side that is nearest to the body.

The Acridiidæ include the grasshoppers of the fields and the important migratory locusts of this country and other parts of the world. The family contains more species and individuals than any other Orthopterous family, and is a most important one, as all its members feed upon growing plants. It includes what are perhaps two of the most dangerous Insect pests in the world—the great North-

West Locust (*Acridium peregrinum* of India) and the Rocky Mountain locust (*Melanoplus spretus* of North America), Insects which at times swarm in millions and clear the country they invade of every green thing. Every leaf is stripped from the trees, every blade of grass consumed and fields of crops eaten down as the flight moves onwards, leaving devastation and ruin in its wake. There are many species of Acridiidæ in India, and many of them at different periods swarm and do damage, but the North-West or migratory locust is the only one which entirely overruns the country when on one of its great incursions. We will consider shortly the life-history of *Acridium peregrinum.*

The home of this locust is in the sandy deserts of Rajputana and Sind, from which it periodically invades the whole of India. The eggs are laid in the ground and hatch out in about a month, but two months or a much longer period may be spent in the egg stage if conditions are not favourable to the young ones hatching out. The young are little blackish wingless grasshoppers, which feed upon green plants of all kinds. (See Frontispiece.) At the end of the first five days after hatching the young locusts or 'hoppers' pack together and march in serried columns into the fields and begin their work of devastation. This stage lasts from one to two months, during which time the insects moult their skins at intervals. Their wings develop during these several moults, and the last shedding of the skin leaves the Insect with perfectly developed alar appendages. As soon as they are full-grown, the locusts quit the areas which they have occupied during their younger stages and from which they have by then eaten everything green, take wing and fly to fresh districts, which they proceed to devastate in a similar manner. After a week or two spent in these wanderings the insects pair and the females commence egg-laying in the soft soil of the cultivated lands, as many as 100 eggs, stuck together in a mass with some siccable substance, being deposited by each insect. Fig. 15 shows the eggs laid by one locust and the shape of the mass. At the egg-laying period they cease feeding or only take a small amount of food, and for this reason are often reported in telegrams, crop reports and newspaper accounts as doing little or no damage. Closer observation would show that they are egg-laying, and the young hoppers hatching from these eggs will later on cause infinitely more destruction in the area than the swarm themselves would have been capable of.

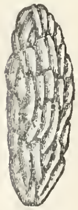

FIG. 15.

When the Insect first acquires wings it is salmon pink in colour, but later it changes to yellow and then to a dull purple. The markings on the wings are very characteristic, the wings having a number of large and small black spots which form complete transverse bands near the apex of the wing. The invasions of this Insect are periodical, the average number of years that elapses between them being about eleven, but a longer interval may pass. The last great attack occurred between the years 1889-1893, but in 1901 the Insect spread from the north-western frontier through the continent as far south as Ganjam in Madras, the whole of the tract between the sea on the West and the Bramaputra River on the East being invaded. Whilst these great flights are present in a district, green foliage of every description suffers severely, and the bark is peeled off young saplings. Crops, orchards and young plantations, &c., thus suffer severely from the pest during great invasions, whilst all tracts containing soft loose sandy soil are used by the females for egg-laying, the eggs being laid by her in a hole in the soil which she digs with the ovipositor (the blade-like instrument) at the end of her body. (See Frontispiece—the insect to the right is a female in the act of egg-laying.) If these eggs are not either dug up and collected or ploughed in so as to destroy them, the young hoppers will on hatching out do further injury to adjacent plants, &c. When swarms of fully developed locusts are seen in a district, every effort should be made to mark down the places at which they alight, if it is not possible to keep them on the move and prevent their doing so. If, after they have left the surface of the soil is seen to be covered with small holes, like holes made in soft earth by heavy rain-drops, eggs have been laid on that area (in the holes) and these should be got rid of before they hatch out, or the young hoppers should be killed off as soon after hatching as possible and *before* they pack into columns, which they begin to do after about five days.

Remedies :—

1. *Eggs.*—Dig up the eggs and destroy them or plough them deep into the soil.

2. *Before formation into column.*—Destroy the young hoppers as soon as they emerge from the eggs and before they pack into columns and begin their march into the fields under crops. This may be done by crushing or burning them. Methods of accomplishing this are by making use of men with flails or by covering the area occupied by the pest with brushwood and setting fire to it. A more satisfactory method

is to sprinkle the Insects with creosote oil, the oil known as 'l'huile lourde' in the trade. This effectually destroys them while at the same time diminishing the terrible stench which will arise from the bodies if the flail is used. The liquid as obtained from the trade is first mixed with 1½ times its weight of water.

3. *After formation into column.*—Dig long dry trenches in the path of the columns, one to two feet in depth, and of the same width and drive the locusts into these. Parties of men, women and boys, armed with branches, etc., can do this, whilst men line the far edge of the trench and throw in earth and bury the insects. As soon as one trench is filled the hoppers can be made to wheel to another and the performance be repeated. Creosote oil, sprinkled in the trenches, will prevent the terrible stench. The earth should be well trampled down to prevent any young locusts escaping. When the hoppers have attained some size this plan can no longer be used as they are then able to hop out of the trenches. It will be found that at this period, when disturbed in the open, they retire to the nearest cover and remain there. Dry material available in the neighbourhood should be collected and spread in patches or long strips. The locusts are then driven into this ambush, surrounded by the people and the patches set on fire. Whole swarms can thus be wiped out. A more expensive plan for annihilating them at this period is by the use of what is known as the 'Cyprus screen' system which is as follows :—

Cloth screens, about 3 feet high and bound at the top with a strip of oil cloth to prevent the locusts from climbing over, are erected in advance of the swarm, pits being dug close to the screens, at right angles to them and on the side of the swarm. The edges of the pit are protected by frames made of cloth and wood with a zinc edge arranged to prevent the young locusts from climbing up and escaping from the pits. A swarm on arriving at the screen invariably turns to the right and left along it, apparently endeavouring to go round it and thus fall into the pits and can be destroyed wholesale. The cultivator will often probably find the simple dry ditch (for young hoppers) and the brushwood and bush systems (for older ones) the best, but the screen system is undoubtedly the one to employ when stations are in danger of invasion from large hordes of this pest. To this end there should be kept in store in all large civil stations and cantonments a few sample screens and trench frames as patterns. From these, when a serious invasion was imminent, the extra number required could be easily knocked up.

4. *For the winged insects.*—The swarms which have newly acquired wings are dangerous as they may spend several weeks flying about and feeding before pairing and egg-laying. When a winged swarm is seen approaching, the people should assemble in the fields armed with tom-toms, kerosine tins, etc., and should be made to advance in bands of 50 beating the instruments. The flight will almost invariably change its direction if this procedure is carried out. Smoke fires and the waving of cloths also seem to frighten the swarms to a certain extent. If swarms of young winged locusts do settle in standing crops they may be treated as follows :—

Drag over the fields a capacious bag, five or six feet deep and eight to ten feet long and open at the side instead of the end. This is held by two men, one at each end, and is run along over the standing crops to catch the locusts ; these tumble in, and being unable to escape can be, from time to time, killed by twisting up the bag. This is a simple and easy method, the people will take to it readily, and little or no injury need be done to the crops.

The old dark coloured swarms do little damage by feeding. They must, however, be carefully watched as they are then intent on egg-laying and every effort should be made in a district to find out where their eggs are laid.

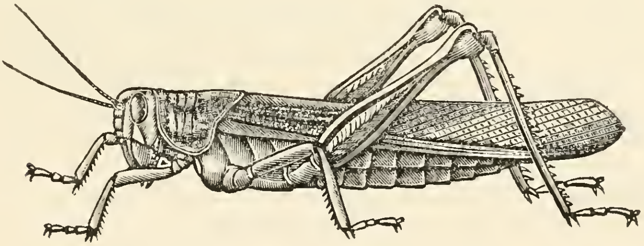

FIG. 16.—The Bombay locust *Acridium succinctum.* (Bombay Presidency) $\frac{1}{1}$.

A fungus has been discovered which destroys locusts. It comes from South Africa and has done good work there and elsewhere. Too little is known of its value, however, in India to make it worth while doing more than mentioning it here.

A. peregrinum is preyed upon by two dipterous parasites, one of which attacks the egg, the other the mature insect. In addition a Carabid beetle (*Calosoma orientale*, Hope) and the rosy pastor starling (*Pastor roseus*) cause great havoc amongst the flights.

Besides the migratory locust proper, most of the provinces of India have one or two large local locusts, which particularly affect their own part of the country and produce the local swarms which on occasions do so much damage.

Acridium succinctum is the locust of the Bombay Presidency. (Fig. 16.) It is a large locust resembling *A. pereginum* from which it can be distinguished by its different colouration. The wings are dark brown at their base, this colour opening out into two broad bands which extend about half way down the wing. Between these bands are several black spots. The apical half of the wing is transparent with a few black marks which lie parallel to the venation of the wing. A broad yellow dorsal band runs down the head and thorax and is continued along the upper edge of the wings. There is also a broad lateral yellow band on the thorax which is continued on to the wings, with a narrow yellow line beneath it on the thorax. The Bombay locust breeds in the Ghats and commits periodically considerable havoc amongst the crops of the Deccan and Konkan. It is also to be found in Western Bengal, and probably breeds in the Chota Nagpur hills. In the Nilgiri range of hills in Madras, *Acridium œruginosum*, *Acridium melanocorne* and *Tryxalis nasuta* (Fig. 17) have their home and are the locusts which at times swarm over the Madras Presidency from that centre. Two species *Tryxalis nasuta*,* and *Oxya velox* have been reported as attacking and injuring young chir (*Pinus longifolia*) and robinia seedlings in Kangra Valley, Punjab. Both these latter insects feed also upon crops and are to be found all over the country. The genus *Tryxalis* can be recognised by the pointed shape of the head, the insect looking as if it had a pointed snout. (See Fig. 17.)

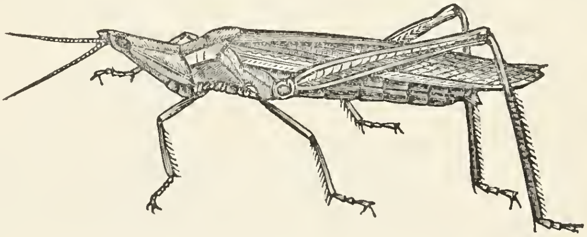

FIG. 17.—The pointed-snouted locust. *Tryxalis nasuta.* (Madras Presidency) $\frac{1}{1}$.

Chrotoganus sp. is another destructive locust as it feeds upon crops of all kinds, biting off the young plants as soon as they appear above the ground. Indigo, *bajra*, opium, wheat, barley, linseed, and young chir plants have been reported as suffering from the attacks of this pest which has proved very troublesome this year (1903) to crops in Sind.

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* See the author's 'Departmental Notes on Insects that affect Forestry,' No. 1, pp. 1—5.

A large amount of investigation work remains to be done amongst the smaller members of the family in India, as it is not improbable that they are capable of developing into serious local plagues when favourable conditions, such as a dry season and the adjuxtaposition of large masses of their favourite food plants, occur.

The remedies already described for the migratory locust should be made use of where possible when the other locust pests of the country give trouble.

Fam. VI. Locustidæ*—Grasshoppers.

These insects are generally known as the long-horned grasshoppers, from the fact of their having very long bristle-like antennæ as compared with the short thick ones of the true locusts. They are usually grass-green or brown in colour, and their bodies are flattened and more lightly built than the true locusts. The eyes are round, the legs slender, and tarsi four-jointed. Wings are roof-shaped. On the tibiæ of each of the front legs there are two auditory organs, and the males make sounds by rubbing the basal portion of one upper wing, the under side of which has a transversely ridged edge, over a corresponding portion of the other. The female possesses a long sabre-like exserted ovipositor. Fig. 18 shows a common long-horned Indian grasshopper from Bombay by name *Cleandrus ligatus*. The specimen depicted is from the Bombay Natural History Society's collections. The eggs are laid on the ground or on leaves, stems, &c.

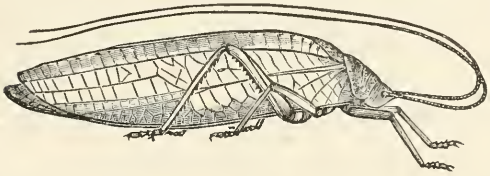

FIG. 18.—A Long-horned Indian grasshopper. *Cleandrus ligatus*. (Bombay) 1/1.

This family is of less importance than the true locusts. It contains the insect known as *Schizodactylus monstrosus*, Brulli, a grasshopper which can be at once recognised owing to the fact that the ends of its wings are curled up in a coil at the end of its body. It lives in burrows in the ground, coming out to feed probably chiefly at night. It is known as 'bherwa' in the indigo districts, where it does a large amount of damage by cutting off indigo, tobacco, and other crop plants with its enormous shear-like jaws. It is also plentiful in Assam, and I believe I am correct in stating that it is to be found in the Madras Presidency. A pest of this kind can commit an incalculable amount of harm amongst young plants. Fig. 19 shows this insect, half natural size. Remedial measures will be the same as those discussed for the crickets below.

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* It will be noted that the Locustidæ are not locusts but grasshoppers, the true 'locusts' belonging to the Acridiidæ—an unfortunate nomenclature which it would be impossible now to change.

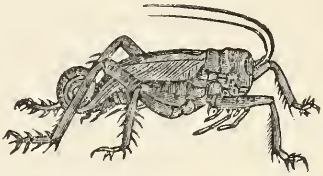
FIG. 19.—*Schizedactylus monstrosus.* (Bengal.) ½ nat. size.

Fam. VII. Gryllidæ—Crickets.

The Gryllidæ are closely connected with the Locustidæ. The antennæ are long and slender and setaceous; hind legs long and used for jumping purposes. The upper wings have the outside portion bent vertically downwards on to the side of the body, whilst the inner portion lies horizontally on the dorsal surface. The tarsi are usually three-jointed. The female has a long exserted ovipositor (see Fig. 20). Wingless forms are numerous. The musical and auditory organs are situated in the same position as in the Locustidæ. The crickets differ from these latter in having the three-jointed tarsi and in the position of the upperwings in repose. The body is thick and cylindrical, and the eggs are glued together and laid in holes in the ground. Fig. 20 shows a black cricket named *Liogryllus bimaculatus* which is exceedingly common round Bombay.

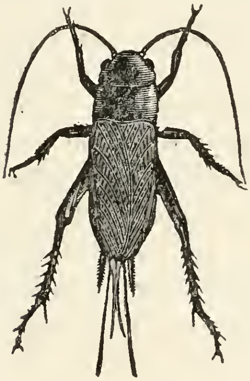
FIG. 20.—Black field-cricket of Bombay. *Liogryllus bimaculatus.* (Bombay).

This family contains some injurious pests, of which two more especially harmful will be mentioned. The mole cricket (*Gryllotalpa vulgaris*) is a large insect, which has the front legs thickened for digging purposes, and has the prothorax enormously enlarged, resembling the carapace of a lobster, and there is no ovipositor present. The forelegs have a very short and thick femur (thigh) and tibia (shank), and the tibia is prolonged into a series of four points and is concave on the outside. The first two joints of the tarsus are prolonged into teeth. The fore wings are very short and oval, and the hind wings are rolled up upon themselves like a rolled-up umbrella and extend back in two points. (See Fig. 21.) This insect is dangerous, as it burrows under ground in grass lands, gardens and nurseries, destroying the roots of plants in its operations.

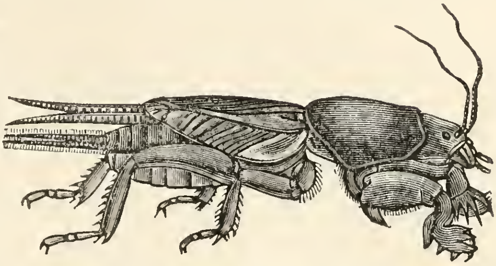

FIG. 21.—The mole-cricket *Gryllotalpa vulgaris.* (Bengal) $\frac{2}{1}$.

The second injurious species which has proved itself a serious pest in India is a cricket (Fig. 22) named *Brachytrupes achœtinus*,* which has a very wide distribution. The life-history of this insect has been partially worked out by the writer and an Assistant in Eastern Bengal (Chittagong Hill Tracts). Larvæ about half grown were found in April voraciously feeding upon young rubber (*Ficus elastica*) seedlings in nursery beds, into which the young plants had been transplanted from the pots in which they had been raised from seed. It was not until some 40 per cent. of the seedlings had been killed off that the aggressor was marked down in the burrows in which it lives. These are constructed in soft sandy situations, the tunnel starting at an angle to the surface level and running in a zigzag manner down into the soil for some 2 feet and having a diameter of ½ to ¾ inch. At the end it is enlarged into a small chamber. A hole may be occupied by one, two, or as many as three young ones. The insect feeds chiefly at night, spending the day in its burrow, into which it drags some of its food plant for consumption during the day. Soft soil is chosen to dig the holes in—and therefore the nursery beds are preferred, but any soft spots in the neighbourhood will be found to contain numbers of the insects. The young larvæ feed till the beginning of the rains—about the middle of June. They then cease until October, and they would appear to rest during the heaviest of the rains, though there is no pupal stage proper in this Order. In October the damage in the nursery recommences, and the holes will be found to contain two fully developed

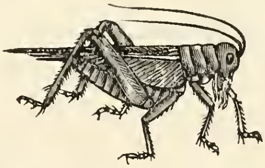

FIG. 22.—Common field-cricket. *Brachytrupes achœtinus.* (Chittagong Hill Tracts.) ½ nat. size.

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* See Departmental Notes on Insects that affect Forestry, No. 1, p. 6.

Insects, male and female, at the bottom of each, the holes being now some 2½ to 3 feet deep and very winding. The Insects at this period feed voraciously, and continue to do so for a month. In November they die off, the female probably first laying her eggs in soft patches of soil in the ground. This cricket has been reported as injurious to young tea plants in Bengal, Assam and elsewhere, cutting off the young plants level with the ground.

Remedies.—All soft patches of soil should be carefully and deeply ploughed or hoed up so as to kill off the eggs by exposing them at the surface. When an attack has been discovered in progress, small boys should at once be put on to dig up each hole and kill the insect at the bottom. This will be found to be a cheap and effectual method of getting rid of the pest, which, if left alone, will do an immense amount of injury. Being a large-bodied insect, some 2½ inches long, it is capable of consuming during its life a considerable amount of green food material.

Useful Orthoptera.

The number of Orthoptera known to be of use to man is a small one. The *Mantidæ* may be said to be useful to a certain extent, in that they destroy insects of all kinds, and in their larval stages in some cases they probably feed largely upon *Aphidæ*. As I have mentioned in my notes under that family, the *Forficulidæ*, in spite of the bad reputation they have amongst gardeners as being injurious to vegetation, are much more likely to be of use, since many are undoubtedly predacious upon larvæ, small snails, &c., which live upon plants.

(*To be continued.*)

A LIST OF THE BATRACHIANS KNOWN TO INHABIT THE MALAY PENINSULA, WITH SOME REMARKS ON THEIR HABITS, DISTRIBUTION, &c.

By A. L. BUTLER, F.Z.S., M.B.O.U., &c.

(*Director of Game Preservation, Soudan Government.*)

INTRODUCTION.

The most recent papers dealing with the Batrachians of the Malay Peninsula as a whole are those published in the "Proceedings of the Zoological Society" (1896 and 1899), by Captain S. S. Flower, formerly in charge of the Royal Siamese Museum at Bangkok, and now Director of the Egyptian Government Zoological Gardens at Cairo.

In the second paper (P. Z. S., 1899, p. 885 *et seq.*) 45 species of Batrachians are recorded from the Peninsula, including *Megalophrys montana*, Kuhl, mentioned somewhat doubtfully in a note, but since obtained again by the "Skeat Expedition," and two species, *Rana jerboa*, Gthr., and *Nectes subasper*, Tschudi, mentioned in the Addenda. Since then 13 other species have been added to the Peninsula list by the collections of the "Skeat Expedition" (P. Z. S., 1900, p. 883) by Mr. Leonard Wray, of the Perak Museum, and myself. A brief list of these additions was given by me in the P. Z. S. of June 17th, 1902 (p. 188).

The present list, therefore, includes 58 species. I originally commenced this paper in the Straits, when in charge of the Selangor State Museum, but a sudden and unexpected departure to a new field of work in Africa separated me from my collections, which of course remained in the Museum, and thus prevented me from being able to give localities and measurements from my specimens as fully as I should have wished. After some hesitation I have since completed the paper, and offer it to the Society with this partial excuse for its shortcomings.

In the brief notes on habits, etc., I have freely supplemented my own field-notes from the writings of others. The known distribution of each species is given, in almost every case taken from Captain Flower's papers or supplied me by Mr. Boulenger. For the benefit of local workers the descriptions of species discovered since the publication of Captain Flower's second paper are quoted in full. I am aware that most Societies are disinclined to occupy space in their journals with descriptions which have already been published, but my own experience is that by this economy of space the usefulness of many papers is marred to field-workers who, in seeking how to recognize a species, find only references to back numbers of bulky journals which they are not in the least likely to have available.

The richness of the Batrachian Fauna of the Malay Peninsula is remarkable, and it is my belief that many interesting species both of Batrachians and Reptiles remain to be discovered, especially in the mountains. On my last collecting trip, in March and April 1900, I was fortunate enough to obtain on the Larut Hills in Perak no less than five frogs, five lizards, and a snake which were previously unknown. I hope that the present paper may assist in drawing attention to this field of research.

Collecting Reptiles and Batrachians does not seem to be nearly as popular as the collecting of birds, but it becomes a very fascinating hobby when once taken up, and has the great advantage that the spirit preservation of specimens takes so little time, whereas a fruitful day's collecting of birds or mammals means to an unassisted man long hours of work at night to prepare the spoils.

In one respect the Reptiles and Batrachians have not suffered by being less popular than the birds. They enjoy a comparative immunity from the bewildering confusion of synonyms, the perpetual changes of nomenclature, and the too often unjustifiable multiplication of sub-species with which ornithologists are forming a burden that future generations of bird-lovers may well hesitate to take up, and which is the despair of the naturalist collector abroad.

For much kind assistance rendered while I was collecting Reptiles and Batrachians in the Peninsula my thanks are especially due to Captain Flower, whose enthusiasm first attracted me to this branch of zoology; to Mr. Boulenger of the British Museum, who amidst his labours always found time to give me identifications, and other information asked for, most fully and promptly, and who would doubtless show the same kindness to other collectors taking up the subject; to Mr. Leonard Wray of the Perak Museum, Mr. H. N. Ridley of the Botanical Gardens, Singapore, and to Dr. Hanitsch of the Raffles Museum, to all three of whom I am indebted for much help and many specimens.

LIST OF SPECIES.

ORDER ECAUDATA.

Family *Ranidæ*.

1. OXYGLOSSUS LIMA, Gravenh.

Oxyglossus lima, Blgr., Cat. Batr. Sal., p. 5; S. Flower, P. Z. S., 1896, p. 897; P. Z. S., 1899, p. 886; Laidlaw, P. Z. S., 1900, p. 884.

This frog has been obtained in the Malay Peninsula by Mr. Flower, who found it numerous in June 1898 near Alor Star and at Jenan in the State of Kedah, and by the Skeat Expedition from Biserat, Jalor. He describes it as a thoroughly aquatic species, to be found in small ponds.

Known from Lower Bengal, Burma, Southern China, Siam, Cambodia, Cochin China, Malay Peninsula, Java.

2. OXYGLOSSUS LÆVIS, Günther.

Oxyglossus lœvis, Blgr., Cat. Batr. Sal., p. 6 ; Blgr., P. Z. S., 1897, p. 228 (tadpole) ; S. Flower, P. Z. S., 1896, p. 897, and P. Z. S., 1899, p. 886 ; Laidlaw, P. Z. S., 1900, p. 884.

Obtained by Mr. L. Wray near Taiping, by Dr. Hanitsch from swamps near Ipoh, Perak, and by the Skeat Expedition from Biserat, Jalor.

Distribution.—Burma, Malay Peninsula, Sumatra, Mentawei Islands, Borneo, Flores, Celebes, Philippines.

3. RANA CYANOPHLYCTIS, Schneider.

Rana leschenaultii, Cantor, p. 138.

Rana cyanophlyctis, Blgr., Cat. Batr. Sal., p. 17 ; Anderson, P. Z. S., 1895, p. 660, pl. xxxvii, fig. 2 (tadpole) ; S. Flower, P. Z. S., 1896, p. 897, and P. Z. S., 1899, p. 887.

Cantor mentioned two specimens from the Peninsula, and speaks of the species as "apparently not numerous." It has never been obtained in the Peninsula since.

Distribution.—S. Arabia, Baluchistan, Cashmere, Himalayas (up to 6,000 feet), India, Ceylon, Malay Peninsula.

4. RANA KUHLII, D. and B.

Rana kuhlii, Blgr., Cat. Batr. Sal., p. 20 ; P. Z. S., 1899, p. 166 ; S. Flower, P. Z. S., 1899, p. 887.

I obtained two specimens in April, in a gloomy ravine on the flank of Gunong Ijau (Larut Hills) at about 4,500 ft. elevation. They were hidden under the *débris* of rotten plantain leaves along the banks of a small stream, into which they dived directly their hiding place was disturbed. I captured my specimens by groping about the bottom of the pools into which I had seen them jump. The larger of the two measured from snout to vent $3\frac{1}{20}$ inches.

Messrs. Hanitsch and Flower had previously obtained specimens from the same locality.

Elsewhere it occurs in Southern China, Burma, Sipora (Mentawei Islands), Java, Borneo, Celebes.

5. Rana laticeps, Blgr.

Rana laticeps, Blgr., Cat. Batr. Sal., p. 20, pl. i, fig. 1; S. Flower, P. Z. S., 1896, p. 897, and P. Z. S., 1899, p. 888.

The frogs which Dr. Hanitsch recorded (Rep. Raffles Library and Museum, 1898) from Gunong Kledang, Perak, as this species are not *R. laticeps* but *R. hascheana.*

The claim of *R. laticeps* to a place on the Peninsula list depends therefore on a single specimen in the British Museum from Malacca (Mr. Hervey) and on Captain Flower's not quite positive identification of a specimen in bad condition in the Raffles Museum from the same locality.

Distribution.—Khassya, Bengal, Malay Peninsula.

6. Rana macrodon, Kuhl.

Rana macrodon, S. S. Flower, P. Z. S., 1899, p. 888; Laidlaw, P. Z. S., 1900, p. 885.

Common and widely distributed in the Peninsula, being found from sea-level up to 4,000 feet on the hills. Captain Flower calls *Bufo asper*, "the grandest Batrachian inhabiting the Peninsula," but I never saw one approaching really fine examples of *Rana macrodon* in size. One of these frogs which I obtained at Kuala Lumpur in January 1899 measured exactly 9 inches from snout to vent, and there is a specimen in the Raffles Museum measuring 9¼ inches. The coloration of this species is extremely variable, especially in the young. On the Larut Hills, at 4,000 feet elevation, where they ran to about 6 inches in length, a uniform yellowish clay-colour was usual; some examples had a pale vertebral stripe, and some were ornamented with a few small orange-red spots upon the back. The 9-inch monsters from jungle-pools in the low-country are very dark olive-brown above, with a strong bluish gloss; beneath yellowish white. A bright brownish-red variety is common in Singapore, and has been figured by Captain Flower, P. Z. S., 1896, Pl. XLY.

Distribution.—" Upper Burma, Tennasserim, Malay Peninsula, Sipora (Mentawei Islands), Java, Lombok, Flores, Natunas, Borneo, Phillippines" (Flower).

7. Rana plicatella, Stol.

Rana plicatella, Stol., S. A. S. B. 1873, p. 116, pl. xi., fig. 1; Blgr., Cat. Batr. Sal., p. 26; S. S. Flower, P. Z. S., 1899, p. 890; Laidlaw, P. Z. S., 1900, p. 885.

Originally described by Stoliczka from a spirit specimen from Penang or Province Wellesley; Flower obtained an adult male in

Penang; the "Skeat Expedition" obtained an adult male and female at the foot of Gunong Inas, and two young at 3,000 and 4,000 feet elevation; and I captured a single specimen on the top of Bukit Timah, Singapore, in June 1900.

The adult males obtained by Flower and by the "Skeat Expedition" had knob-shaped prominences on the occiput. Stoliczka does not mention this in the description of his specimen (sex not mentioned) and the knob was absent in my example (not sexed). It is probably, as suggested by Flower, a sexual characteristic of the adult male.

8. Rana tigrina, Daud.

Rana tigrina, Cantor, p. 139; Boul., Cat. Batr. Sal., p. 26; id. Fauna Brit. Ind., Rept., p. 449 (figured); Flower, P. Z. S., 1896, p. 901; P. Z. S., 1899, p. 891; Laidlaw, P. Z. S., 1900, p. 885.

I am inclined to think this frog must be rather local in its distribution in the Peninsula, and probably more abundant in the Siamese States than in the South. In three and-a-half years' collecting I never met with it. Cantor writes of it as "excessively numerous in valleys and hills after heavy falls of rain." In the Peninsula it has been obtained from Penang, Province Wellesley, Kedah, Patani and Kelantan.

It has a wide range: Flower gives the distribution as Nepal, Sikhim, India, Ceylon, Burma, China, Formosa, Siam, Malay Peninsula, Java, Borneo, Celebes, Philippines, Lombok, Ombaai, Sumba.

9. Rana limnocharis, Boie.

Rana gracilis, Blgr., Cat. Batr. Sal., p. 28.

Rana limnocharis, Blgr., Fauna. Ind., Rept., p. 450; Flower, P. Z. S., 1896, p. 901, and 1899, p. 893; Laidlaw, P. Z. S., 1900, p. 885.

Common and widely distributed in the Peninsula. This is the only batrachian which I have found in brackish water in tidal creeks and ditches.

According to Flower it is known elsewhere from Sikhim, India, Ceylon, Burma, China, Hongkong, Hainan, Formosa, Japan, Siam, Java, Lombok, and Borneo.

10. Rana hascheana, Stol.

Polypedates hascheana, Stol., J. A. S. B., 1870, p. 147, pl. ix., fig 3.

Rana hascheana, S. Flower, P. Z. S., 1896, p. 902, and P. Z. S., 1899, p. 894.

Stoliczka found this frog common all through the higher forests of Penang (about 1,000 ft.) and Flower obtained it from the same locality.

It is this species which Dr. Hanitsch obtained on Gunong Kledang, Ipoh, Perak, at 2,000 ft. elevation and recorded under the name of *R. laticeps* (Rep. Raffles Libr. and Mus., 1898).

I got specimens in March 1900 on the Larut Hills, Perak, from 2000 to 3000 ft. elevation. It croaks throughout the day, uttering a single very loud crow-like caw two or three times in succession and then remaining silent for some minutes. When tracked down the frog is almost always found under a dead leaf, not in a hole of any sort. It is extremely active and hard to catch, making off with long leaps through the undergrowth directly it is disturbed. They appear to be especially numerous at just about 2,000 ft., at which elevation the jungle resounded with their loud calls.

In croaking the throat is greatly inflated.

Flower has described this species with his usual accuracy and to his description I can only add that the ground colour varies from "rich yellow" to orange brown in different individuals.

R. hascheana is also known from the Natuna Islands.

11. Rana erythræa, Schl.

Rana erythræa, Boul., Cat. Batr. Sal., p. 65 ; Flower, P. Z. S., 1896, p. 902, pl. xlv, fig. 2, and P. Z. S., 1899, p. 895 ; Laidlaw, P. Z. S. 1900, p. 885.

Common throughout the Peninsula in suitable localities ; confined to the low country and never found away from water.

This pretty frog is usually rather shy, but those which inhabit the small ponds in the Botanic Gardens, Singapore, have become so accustomed to gardeners drawing water, etc., that they are charmingly tame. I found that if quietly approached they would frequently take insects from my fingers, and when tickled with a piece of grass would push it away with their hind legs instead of moving.

Distribution.—Burma, Siam, Malay Peninsula, Sumatra, Borneo, Celebes, Philippines (Flower).

12. Rana macrodactyla, Günther.

Rana macrodactyla, Blgr., Cat. Batr. Sal., p. 54 ; Flower, P. Z. S., 1899, p. 895 ; Laidlaw, P. Z. S., 1900, p. 885.

Obtained by Flower near Jenan and Alor Star, Kedah, and since by the Skeat Expedition near Biserat, Jalor.

Distribution.—Burma, South China, Siam, Malay Peninsula (Flower).

13. Rana labialis, Blgr.

Rana labialis, Blgr., Ann. and Mag. Nat. Hist. (5), xix, 1887, p. 345, pl. x, fig. 1; S. Flower, P. Z. S., 1896, p. 903, pl. xlv, fig. 3 (tadpole); P. Z. S., 1899, p. 896; Laidlaw, P. Z. S., 1900, p. 886.

Originally described from specimens from Malacca, collected by Mr. Hervey; since obtained in the Botanical Gardens, Singapore, by Mr. Ridley and Mr. Flower, by myself in Selangor and by the Skeat Expedition on Gunong Inas. In his first paper Flower states that he caught two specimens "in a small pond," associating with *Rana erythræa*, which agrees with its habits as described to me by Mr. Ridley; in his second paper, however, he says that his specimens were "in each case, observed sitting on the leaves of plants or in bushes, so it evidently is not a true water-frog like *Rana erythræa*." He describes it as having the upper parts bright green and the lower immaculate white. A Singapore specimen given me by Mr. Ridley agrees well with this description, but a variety obtained by me in Selangor (identified by Mr. Boulenger) is somewhat different. The back was bronze-brown, with indistinct black spots; the lips light golden; the sides dark green, distinctly separated from the bronze of the back; beneath silvery white, the throat mottled with a few brown spots. Caught in a fast running stream in jungle on the Cheras Road, near Kuala Lumpur.

Also known from the Mentawei Islands.

14. Rana jerboa, Gthr.

Rana jerboa, Bouleng., Cat. Batr. Sal., p. 67, and Ann. Mus. Genova (2), xiii, 1893, p. 335.

I have at different times obtained five examples of this frog from the Batu Caves, Selangor. They were a long distance underground, but were not in total darkness, frequenting a pile of moist rocks beneath a shaft communicating with the open air. These appear to be the only specimens recorded from the Malay Peninsula. Two of them measure $1\frac{21}{40}$ and $1\frac{3}{5}$ inches from snout to vent.

Habitat.—Karin Hills, Borneo, Java, Malay Peninsula.

15. Rana luctuosa, Peters.

Rana luctuosa, Blgr., Cat. Batr. Sal., p. 68; S. Flower, P. Z. S., 1896, p. 904, pl. xlvi; P. Z. S., 1899, p. 896.

This frog, originally known from Borneo, was first recorded from the Malay Peninsula by Captain Flower, who obtained it near small ponds on the Penang Hill in November 1896 and March 1898. I obtained two examples on the Larut Hills in March and April 1898, and in the same months of this year (1900) I found it plentiful round the small water holes in the Hill Gardens, Larut. I obtained 22 specimens. Subsequently some coolies, who were looking out for frogs for me, inspired by visions of unlimited small change (calculating on the rate of 10 cts. per frog, which I generally paid for specimens of any use to me), took the trouble to drain off a small pond into which a number of these frogs had been seen to dive and bagged half a kerosine tin full of them, over a hundred. These I looked over and released.

Flower's description of this species is, as usual, exceedingly accurate, but I do not think the colouring on the back is in any way dependent on age. Flower says : "Top of head and back rich dark chocolate brown (in very small frogs the back is a very bright red, more vermilion than chocolate)." I found this bright red quite common among some of the largest I examined, while many of the smallest were of the dark chocolate tint.

In one fine adult the marbling on the thighs was of the same rich chocolate red as the back. Four average sized adults measure from snout to vent $2\frac{1}{5}$, $1\frac{27}{40}$, $2\frac{3}{40}$, $1\frac{19}{20}$ inches.

A tadpole with the fore-limbs still undeveloped measured from snout to vent $1\frac{3}{40}$, tail $1\frac{19}{20}$, hind limbs $1\frac{5}{8}$ inch in length.

16. RANA GLANDULOSA, Blgr.

Rana glandulosa, Blgr., Cat. Batr. Sal., p. 73, pl. vii ; S. Flower, P. Z. S., 1896, p. 905 ; P. Z. S. 1899, p. 897 ; Laidlaw, P. Z. S., 1900, p. 887.

Known from Perak, Malacca, and Singapore in the Malay Peninsula. Elsewhere from Borneo and Palawan.

I have obtained examples in Selangor, but it is not common. There was one small specimen in the museum when I took up the curatorship in 1898. In March 1899, I captured a fine pair under a large heap of tiles in a compound in Kuala Lumpur, and took another in one of the Batu Caves in total darkness. I have seen it once or twice in swamps lying in tracts of "*lalang*" grass.

The eye of this frog is a conspicuous fiery red.

17. RANA LARUTENSIS, Blgr.

Rana larutensis, Blgr., Ann. and Mag. N. H. (7), iii, 1899, p. 273, pl. xi, fig. 1 ; Flower, P. Z. S., 1899, p. 898 ; Laidlaw,· P. Z. S., 1900, p. 886.

These frogs are extremely plentiful in rocky streams on the Larut Hills (where the species was discovered by Flower in 1898) but are extraordinarily difficult to catch. Their mottled colouring renders them almost invisible when sitting on the granite rocks; they dive directly one attempts to approach them, swimming with ease in the strongest current and concealing themselves in crevices under water.

I got them from the foot of the hill at an elevation of 3,000 feet. The Skeat Expedition procured specimens from streams at the foot of Gunong Inas.

18. RANA SIGNATA, Günther.

Rana signata, Boulenger, Cat. Batr. Sal., p. 71; Laidlaw, P. Z. S., 1900, p. 886.

Obtained by the Skeat Expedition at the foot of Gunong Inas.

Previously known from Borneo.

19. RANA LIVIDA, Blyth.

Rana livida, Boulenger, Fauna Ind., Rept., p. 462.

Mr. Boulenger has identified a specimen obtained in the Larut District, Perak, by Mr. L. Wray.

It was previously known from the Himalayas and Assam to Tenasserim.

20. RANA LATERALIS, Blgr.

Rana lateralis, Boulenger, Ann. Mus., Genov. (2), v, 1887, p. 483, pl. viii, fig. 2, id. "Fauna of India," Rept. and Batr., p. 457; Laidlaw, P. Z. S., 1900, p. 886.

A single frog obtained by the Skeat Expedition in thick jungle at Kuala Aring, in the Siamese Malay States, is referred to this species. Previously known from Borneo only.

21. RANA DORIÆ, Blgr.

Rana doriæ, Boulenger, Ann. Mus., Genova (2), v, 1887, p. 482, pl. iii, fig. 1; ib. xiii, 1893, p. 328, pl. viii, fig. 1; Faun. Ind., Rept. p. 447.

A single example of *Rana doriæ* obtained by Mr. L. Wray in Larut, Perak, has been identified by Mr. Boulenger. Previously known from Karin Hills, Tenasserim, Mergui.

22. ? RHACOPHORUS HECTICUS, Peters.

Rhacophorus hecticus, Blgr., Cat. Batr. Sal., p. 78.

Captain Flower considered that a large *Rhacophorus* in the Perak State Museum possibly belonged to this species.

Described from Samar Island, Philippines.

23. RHACOPHORUS LEUCOMYSTAX, Gravenh.

Rhacophorus maculatus, Part., Boulenger, Cat. Batr. Sal., p. 83.

Rhacophorus leucomystax, Boulenger, P. Z. S., 1889, p. 29 ; id. Fauna Ind., Rept., p. 474 ; S. S. Flower, P. Z. S. 1899, p. 898, pl. lix, figs. 3, 3a ; Laidlaw, P. Z. S., 1900, p. 887.

One of the commonest and most widely distributed of Malayan frogs. Its coloration is very variable, and six or seven different colour-varieties have been described by Captain Flower. It is known to the Malays as "Katak Pisang" (plantain frog), the broad glossy leaves and stems of the plantain affording it a favourite refuge. In almost any verandah where plants are kept these frogs are sure to be found and may be noticed towards sundown crawling about among the pots or trellis work in search of insects. As is the case among many Malayan frogs, the tadpoles are developed and released from the ova very rapidly. The spawn is usually deposited in a frothy mass on leaves, twigs or planks just touching, or just above, the surface of water. About houses, tubs of rain water are commonly used as breeding places. I remember a case in which *all* the tadpoles hatched from one batch of eggs laid under my observation had a most curious kink in the tail ; I never saw this peculiarity in others and am puzzled to account·for it.

I have found this species common on the hills up to 5,000 feet, as well as throughout the low country.

Distribution.—Sikhim, Assam, Burma, Southern China, Hongkong, Formosa, Cambodia, Cochin China, Siam, Malay Peninsula, Java, Samba, Borneo, Celebes, Philippines (Flower.)

24. RHACOPHORUS BIMACULATUS, Blgr.

Rhacophorus bimaculatus, Bouleng., Cat. Batr. Sal., p. 90 ; Faun. Ind., Rept., p. 472 ; Ann. Mus., Genova (2), xiii, 1893, p. 339.

A single specimen of this frog was identified by Mr. Boulenger among some reptiles and batrachians recently sent home by Mr. L. Wray, Jr., from Larut, Perak. No other naturalist appears to have met with it in the Peninsula.

Habitat.—E. Himalayas, Assam (Khasi Hills), Karin Hills, Malay Peninsula (Larut Hills).

25. RHACOPHORUS NIGROPALMATUS, Blgr.

Rhacophorus nigropalmatus, Bouleng., Ann. and Mag. Nat. Hist. (6), XVI, p. 170 (1895) ; S. S. Flower, P. Z. S., 1899, p. 899 ; Hanitsch, Journ. Str. Br. R. A. S., No. 34, p. 96.

Only three specimens of this "Flying Frog" have been recorded. The first was obtained by Mr. Chas. Hose from the Akan River, Borneo ; the second by Mr. L. Wray, Jr., in the Piah Valley, Upper Perak; the third by Mr. A. D. Machado in Pahang.

Each of these examples has been fully described : the references are given above.

The second and third specimens are preserved in the Perak and Singapore Museums.

Length from snout to vent in these specimens 80, 84 and 98 millim.

The claim of this and some allied species to the name of "Flying" Frog still, I believe, rests on the statement of a Chinaman to Mr. Wallace that he saw one fly from one tree to another.

26. RHACOPHORUS LEPROSUS, Schl.

Polypedates leprosus, Günther, A. & M. N. H. (5), XX, 1887, p. 315, pl. xvi, figs. A, a, a1.

Rhacophorus leprosus, Boul., P. Z. S., 1890, p. 284 ; Flower, P. Z. S., 1896, p. 907.

About six or eight specimens of this curious frog were obtained by Mr. Wray at 4,000 ft. on the Larut Hills. They were all taken at the same spot, the vicinity of a stream on the flank of Gunong Ijau, about a mile from the "Cottage." After failing to find a single specimen during three different visits to the hills—of two months, a week, and a month—I got Mr. Wray to direct me to the exact spot, which I searched diligently for several mornings, but in vain. Flower quotes Mr. Wray as saying that it "lives in holes in trees, etc." ; Mr. Wray told me he caught all his *on* the trunks of trees, upon which it was very difficult to detect owing to its roughened reddish brown back harmonizing so well with the bark. Possibly Mr. Wray's note was confused with one relating to another species. There is a good cast of this frog, done by Mr. Wray, in the Perak Museum.

Habitat.—Malay Peninsula, Sumatra.

27. IXALUS PICTUS, Ptrs.

Ixalus pictus, Peters, Mon. Berl. Ac., 1871, p. 580 ; Peters, Ann. Mus. Civ., Genova, III, 1872, p. 44, pl. vi, fig. 3 ; Boulenger, Cat. Batr. Sal., p. 99 ; Flower, P. Z. S., 1896, p. 908.

On the 22nd of March 1900 my friend Mr. A. Hale, with whom I was collecting on the Larut Hills, detected and pointed out to me one of these very beautiful little tree-frogs which was sitting on a stick among some dead leaves at the side of a path in jungle at 4,000 ft. elevation. The species was originally known from Borneo, and the only other specimen recorded from the Peninsula is one caught on

Bukit Timah, Singapore, by Dr. Hanitsch of the Raffles Museum in February 1896 and now in the British Museum.

The colouring of this frog is particularly pretty, but fades rapidly in the spirit specimen. The following description was jotted down from the living example :

Above bright reddish orange, the body and limbs spotted with irregular sharply defined patches of cream colour. Beneath clear brownish orange, the lips with spots and the throat with patches of cream colour. Abdomen white with sharply contrasted blotches of greenish black ; the white of the abdomen commencing in a point on the pectoral region and abruptly separated from, not blending into, the orange of the sides. Edges of limbs and feet minutely spotted with yellowish.

Iris, above the pupil golden, beneath pupil bronze brown.

Also known from Borneo.

28. IXALUS ASPER, Blgr.

Ixalus asper, Boul., P. Z. S., 1886, p. 415, pl. xxxix, fig. 1 ; Flower, P. Z. S., 1896, p. 908.

Described from a few specimens obtained by Mr. L. Wray at 3,300 feet on the Larut Hills. Mr. Wray kindly gave me one of those caught at the same time as the types ; it has faded in spirit during the lapse of fourteen years to a dull whitish colour. In April 1900 I got three examples on the Larut Hills at 3,500 to 4,000 feet.

Above ashy grey, on the back a large mark shaped like a broken-pointed arrow-head directed forwards ; this mark is greyish brown, indistinctly edged with rich burnt sienna, and brightening into olive green on the sides. Head below the eyes blackish tinged with burnt sienna. Limbs bluish grey with some black bars. Lower surface of head and throat black ; remaining lower parts light bluish grey, with black patches at the bases of the forelimbs and the abdomen boldly mottled with blackish.

All three of my specimens were identical in colour.

Flower states that this frog has been taken in Burma as well as the Malay Peninsula.

29. IXALUS LARUTENSIS, Blgr.

Ixalus larutensis, Bouleng., Ann. and Mag. Nat. Hist. (7), Vol. VI, Aug. 1900, p. 187.

I captured numerous specimens of this new *Ixalus* on the Larut Hills in April 1900, at elevations of 4,000 to 4,500 feet.

I reproduce Mr. Boulenger's description :

" Snout rounded or obtusely pointed, as long as the diameter of the orbit ; canthus rostralis distinct ; loreal region concave ; nostril a little nearer the end of the snout than the eye ; interorbital space as broad as the upper eyelid ; tympanum moderately distinct, half the diameter of the eye. Fingers free ; toes half-webbed ; disks of fingers as large as the tympanum ; subarticular tubercles moderate ; a small inner metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the tip of the snout. Upper parts smooth or with small flat warts ; throat, belly, and lower surface of thighs granulate. Grey-brown or reddish-brown above, with dark brown symmetrical markings, a cross-band between the eyes being constant ; usually a)(or)—(marking on the anterior part of the body ; sides of body and of thighs with white spots between a brown net-work ; limbs with dark cross-bands ; lower parts white, spotted or speckled with brown.

" From snout to vent 35 millim."

30. IXALUS VERMICULATUS, Blgr.

Ixalus vermiculatus, Bouleng., Ann. and Mag. Nat. Hist. (7), Vol. VI, Aug. 1900, p. 187.

I obtained three specimens in April 1900 on the Larut Hills at an elevation of 4,000 feet. They were taken among the ferns, moss, etc., on the banks of the bridle-road leading to the Cottage.

Mr. Boulenger describes the species thus :

" Head large, broader than long ; snout rounded, as long as the diameter of the orbit ; canthus rostralis distinct ; loreal region concave ; nostril a little nearer the end of the snout than the eye ; interorbital space as broad as the upper eyelid ; tympanum distinct, two-fifths the diameter of the eye. Fingers with a rudiment of web ; toes half-webbed ; disks of fingers as large as the tympanum ; subarticular tubercles moderate ; a small inner metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the tip of the snout. Upper parts smooth ; throat, belly, and lower surface of thighs granulate. Olive-green above, closely vermiculate with black ; upper surface of thighs with a series of large black blotches ; sides of thighs and anal region orange-yellow ; white beneath. Male with a large gular vocal sac.

" From snout to vent 33 millim."

(*To be continued.*)

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES II. PART X.

(*With Plate C.*)

BY SIR G. F. HAMPSON, BART., F.Z.S., F.E.S.

(*Continued from page* 37 *of Vol. XV.*)

Moths of India—5a.

ENDOTRICHINÆ.

4487*a*. ENDOTRICHA ALBICINCTALIS, n. sp.

♂. Head, thorax and abdomen ochreous, the last slightly tinged with rufous and irrorated with fuscous. Forewing ochreous, tinged with rufous and irrorated with black; a series of small whitish spots on costa; a medial white band diffused on outer side and narrowing to costa; a diffused black subterminal line, very slightly curved. A terminal series of black points; cilia white at tips. Hindwing ochreous, tinged with rufous with rather broad white medial band with diffused black scales before and beyond it and some on its medial part; a terminal series of black points; cilia white at tips.

Habitat.—Kashmir, Dras (Leech). *Exp.* 22 mill. *Type*—In B. M.

4489*a*. ENDOTRICHA OCHRIFUSCALIS, n. sp.

♀. Brownish ochreous, strongly irrorated with fuscous, the basal segments of abdomen and the costal and terminal areas of forewing less strongly irrorated. Forewing with traces of curved ochreous antemedial line, an ochreous discoidal lunule and three small spots on costa towards apex; both wings with traces of a fine pale sinuous subterminal line more distinct on underside; a fine black terminal line and line through the cilia.

Habitat.—Khasis. *Exp.* 20 mill. *Type*—In Coll. Rothschild.

4497*b*. ENDOTRICHA MEDIOLINEATA, n. sp.

♀. Vinous purple, irrorated with fuscous; head paler. Forewing with black lines just before and just after middle, the former slightly angled on median nervure, the latter just below costa. Hindwing with two slightly sinuous almost medial black lines. Underside pinker, the antemedial line absent, the postmedial more prominent.

Habitat.—Sikhim 2800′ (Pilcher). *Exp.* 14 mill. *Type*—In B. M.

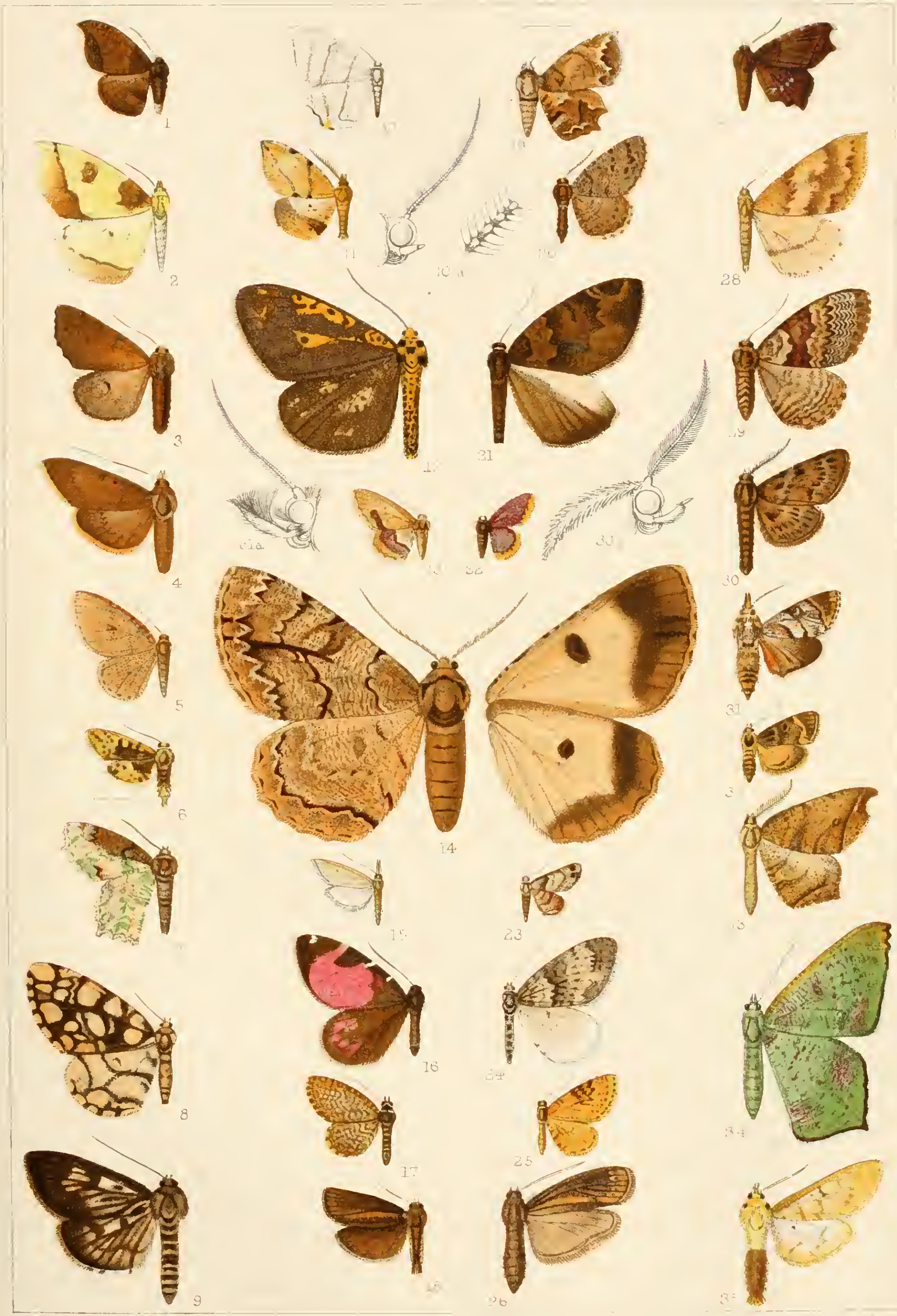
4503*a*. TRICHOPHYSETIS CRETACEA. Butl. Ill. Het. III., p. 75, pl. 59., f. 8.

Paraponyx obnubilalis—Christ. Bull. Mosc. LVI., p. 32.

Trichophysetis neophila—Meyr. Trans. Ent. Soc., 1884, p. 287.

White; palpi blackish at sides; abdomen with dorsal black patch on four medial segments. Forewing slightly tinged with brown; two antemedial brown lines slightly angled below costa, the outer blackish at middle; a white discoidal lunule; two postmedial brown lines strongly excurved below costa, then obsolescent, oblique, slightly angled below veins 2 and 1, and the inner line black in parts; a fine terminal dark line and white subapical patch. Hindwing with double antemedial and medial lines, obsolescent towards costa.

Sir G F HAMPSON. Journ Bomb Nat Hist Soc. Plate C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INDIAN MOTHS

waved and strongly marked with black towards inner margin; a fine terminal black line.

Habitat—Amur, Japan, Simla, Australia, Norfolk I. *Exp.* 16 mill.

4505*a*. TRICHOPHYSETIS ACUTANGULALIS, n. sp.

White; palpi and antennæ tinged with fulvous; abdomen dorsally tinged with fulvous and with a tuft of dark scales on 2nd segment. Forewing more or less strongly suffused with fulvous yellow leaving the costa white; some fuscous suffusion in base of cell; a double black antemedial line very acutely angled on median nervure and slightly sinuous; a similar strongly curved postmedial line very oblique from costa to vein 4; an oblique fulvous shade running across apical area, then on inner side of the fine crenulate black subterminal line to inner margin; a tooth of long black and white hair on inner margin before middle. Hindwing white; a double black antemedial line from cell to inner margin above which it is angled; a curved postmedial line becoming double and sinuous towards inner margin and with black suffusion beyond it from vein 2 to tornus; a fine curved subterminal line arising from the same point as the postmedial line and oblique to vein 4.

Habitat.—Palni Hills, Kodaikanal, 6000′ (W. H. Campbell). *Exp.* 24 mill. *Type*—In B. M.

PYRALINÆ.

4529*a*. PYRALIS PREPIALIS, n. sp.

Head and thorax ochreous; metathorax edged with dark brown; abdomen black with the anal tuft red. Forewing with the basal half bright red-brown bounded by a pure white line expanding slightly to costa; the medial area grey with four white points on costa and a dark discoidal point; a wedge-shaped postmedial white patch from costa to vein 5 with traces of a line from it to inner margin, the area beyond it fiery red suffused with crimson. Hindwing dark brown; fine pale waved ante- and postmedial lines; the terminal area mostly suffused with blue-grey; termen and cilia crimson red.

Habitat.—Sikhim, 3000′ (Pilcher). *Exp.* 19 mill. *Type*—In B. M.

4536*a*. TEGULIFERA PHÆAPTERA, n. sp.

♂. Head and thorax yellowish white; tegulæ and patagia thickly irrorated with purplish fuscous; legs marked with fuscous; abdomen thickly irrorated with black, leaving narrow segmental white lines. Forewing almost entirely suffused with brownish fuscous leaving slight traces of the pale ground colour. Hindwing yellowish white with curved dark postmedial line interrupted below vein 2; the termen suffused with fuscous; a fine line through the cilia.

Habitat.—Ceylon, Puttalam (J. Pole). *Exp.* 18 mill. *Type*—In B. M.

4543*a*. STEMMATOPHORA SUBFLAVALIS, n. sp.

♂. Yellow brown tinged with purplish red; head yellower; thorax and abdomen slightly irrorated with black. Forewing slightly irrorated with black; the base of costal area suffused with black; an antemedial black line obtusely angled on median nervure, then oblique; a black discoidal spot; a postmedial line defined by whitish on outer side and slightly excurved from below costa to vein 3; cilia blackish with a pink line through them. Hindwing with black antemedial and medial lines, the former angled on median nervure, the latter at vein 2 and defined by whitish on outer side; cilia blackish with a pale line through them. Underside of wings ochreous yellow.

Habitat.—Ceylon, Maturatta (Pole). *Exp.* 26 mill. *Type*—In B. M.

4545*a*. STEMMATOPHORA MINORALIS, n. sp.

Head and thorax pale yellowish brown irrorated with fuscous; abdomen pale tinged with rufous, and irrorated with fuscous and with pale segmental lines. Forewing pale yellowish brown irrorated with rufous and fuscous; a sinuous black antemedial line angled outwards in submedian fold and defined by grey on inner side; a black discoidal spot; a black postmedial line excurved beyond cell and above inner margin and defined by grey on outer side; a black terminal line. Hindwing brownish grey irrorated with dark brown; a sinuous dark postmedial line defined by grey on outer side; a black terminal line.

Habitat.—Ceylon, Peradeniya (Green), Colombo (Mackwood). *Exp.* 18 mill. *Type*—In B. M.

4557*a*. HERCULIA MEDIALIS, n. sp.

♂. Olive green tinged with rufous. Forewing with the ante- and postmedial lines white, the former slightly sinuous, the latter strongly angled outwards at vein 4, the medial area suffused with dark brown especially towards the lines; a dark discoidal point and a series of white points on medial part of costa; a terminal series of black striæ; cilia black irrorated with white and with a black line through them. Hindwing with curved diffused medial fuscous line; a terminal series of black striæ; cilia black irrorated with white and with white line through them.

♀. More strongly tinged with rufous.

Habitat.—Simla (Nurse). *Exp.* ♂ 29, ♀ 24 mill. *Type*—In B. M.

Genus: LAMACHA.

Lamacha, Wlk., XXVII., 8 (1865).

Diboma, Wlk., XXVII., 8.

Methora, Wlk., XXXIV., 1517 (1865).

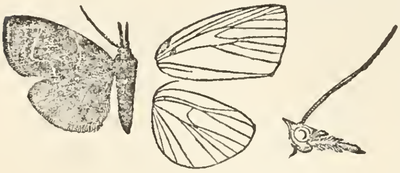
Type—*L. bilineolata* Wlk., from China.

Range.—China, Assam, Borneo, Java.

Palpi porrect, down curved, extending about three times length of head and fringed with hair above and below; maxillary palpi triangularly scaled; proboscis well developed; frons with a sharp tuft; antennæ almost simple; tibiæ slightly hairy. Forewing broad, the costa arched at base then nearly straight, the apex rectangular; the termen excurved at middle; vein 3 from before angle of cell; 4·5 separate at origin; the discocellulars highly curved, 6 from upper angle; 7 from 8 before 9; 10·11 from cell; male with a glandular swelling at base of costa below, the retinaculum hairy Hindwing with veins 2 and 3 from near angle of cell; 4·5 from angle; 6·7 stalked.

4579*a*. LAMACHA ANGULIFERA, n. sp.

♀. Head, thorax and forewing dark rufous brown; abdomen fuscous. Forewing with the basal and terminal areas slightly suffused with fuscous; a pale antemedial line angled below costa, then slightly incurved; a black discoidal spot; the postmedial line pale, obliquely curved from costa to vein 2, where it is sharply angled and retracted. Hindwing fuscous with indistinct pale curved postmedial line; the termen and cilia pink.



Lamacha angulifera ♀ $\frac{1}{1}$.

Habitat.—Khásis. *Exp.* 34 mill. *Type*—In B. M.

4626*a*. TYNDIS ALBIDEFINIS, n. sp.

Grey suffused and irrorated with rufous. Forewing with the costa dark brown with white points between the ante- and postmedial lines which are white, the former nearly straight defined by diffused dark scales on outer side, the latter excurved between veins 6 and 2 and defined by fuscous on inner side; a dark discoidal spot on a paler patch; a dark terminal line; cilia dark brown mixed with grey. Hindwing dark brown with indistinct pale curved postmedial line, some dull rufous towards tornus; a dark terminal line; cilia dark brown mixed with grey.

Habitat.— Simla. *Exp.* 22 mill. *Types*—In Coll. Rothschild and B. M.

HYDROCAMPINÆ.

4633*a*. ERISTENA STRAMINEALIS, n. sp.

♂. Pale ochreous, strongly irrorated with black; abdomen with diffused black bands. Forewing with antemedial black line obliquely curved from costa to submedian fold, then strongly bent inwards to vein 1; a prominent discoidal black spot; the postmedial line whitish, strongly defined by black suffusion on inner side, oblique from costa to vein 5, then inwardly oblique and dentate. Hindwing with waved antemedial line; a black discoidal spot; the medial area suffused with black except towards costa; the postmedial line whitish, waved, strongly defined by black on inner side and slightly on outer.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 16 mill. *Type*—In B. M.

4635. Will stand as NYMPHULA TURBATA; N. RESPONSALIS, Wlk. from Queensland is a distinct species.

4645*a*. NYMPHULA HAMPSONI, South Trans. Ent. Soc., 1901, p. 420, pl. 14., f. 28.

White tinged with pale rufous; palpi black above; frons above and tegulæ behind with two black spots; fore tibiæ black above; abdomen with dorsal black band on 2nd segment and spots on 4th and 5th. Forewing with subbasal black points below costa, median nervure and vein 1; a double antemedial fulvous line, angled outwards below costa, then oblique and with black point on its outer edge in submedian fold; a white discoidal lunule; a double fulvous postmedial line, slightly sinuous below costa, oblique from costa to vein 3 near termen, then erect to just before tornus and with white patch on it; apical area deep fulvous, a short oblique black bar from apex with white line on its inner side, bent inwards at extremity and with some black scale, near it; a subterminal series of black points with some white and black scales before the point below apical bar. Hindwing with double obliquely curved antemedial line, the inner fulvous, the outer black developed into a spot in submedian fold then interrupted; a double postmedial line, the inner black, the outer fulvous, oblique from below costa to vein 1, then recurved to inner margin above tornus; subterminal black points above and below vein 5; the underside with double curved subterminal line, showing through to upperside, the inner black, the outer fulvous, strongly incurved to costa. Forewing with vein 10 from the cell.

Habitat.—W. China, Ichang, Khásis. *Exp.* 24 mill.

4658*a*. AMBIA CYANEALIS, n. sp.

♂. Forewing with vein 4·5 from cell; hindwing with veins 3·4 stalked; antennæ strongly annulate.

Black brown; palpi below, pectus, legs except fore tibiæ and tarsi and ventral surface of abdomen whitish. Forewing with indistinct pale antemedial line slightly angled on median nervure and with some silvery blue suffusion before it, a black-edged white spot in end of cell with some blue scales round it; a postmedial whitish line oblique from costa to vein 6 where it is angled outwards and again at vein 2, and with silvery blue suffusion, beyond it from below costa to vein 2; a black terminal line; cilia white below apex and above tornus. Hindwing with indistinct whitish ante- and postmedial lines, the former angled outwards below cell, the latter at veins 2 and 1; some irregular silvery blue markings on terminal area; a black terminal line; cilia white at the excisions.

Habitat.—Ceylon, Matale (Pole). *Exp.* 10 mill. *Type*—In B. M.

P. 207. Under OLIGOSTIGMA insert *Hemiloba* Swinh. A. M. N. H. (7) viii, p. 24 (1901).

Mid and hind coxæ of male and hind femora tufted with hair; forewing with the termen deeply excised at middle, hindwing with the termen deeply excised below apex and middle.

4677*a*. OLIGOSTIGMA EXCISA, Swinh. A. M. N. H. (7) viii. p. 24 (1901).

♂. Orange. Forewing with a white fascia suffused with fuscous in and below cell to lower angle where it is confluent with a wedge shaped patch extending to tornus; a black point on costa above end of cell with a wedge-shaped fuscous—suffused white patch beyond it; a highly sinuous black subterminal line with silvery white on its inner edge on costal half; a black point at apex. Hindwing with oblique white medial band edged by sinuous black lines; a subapical black-edged white spot; a white spot with black points round it on the lobe at middle of termen and a black subterminal line towards tornus.

Habitat.—Assam Jaintia Hills. *Exp.* 18 mill.

4681*a*. OLIGOSTIGMA AUROPUNCTALIS, n. sp.

♀. White; abdomen tinged with ochreous towards extremity. Forewing slightly irrorated with brown; a medial yellow patch on inner area; a medial black point on costa with fuscous line from it to inner margin where it meets an obliquely incurved postmedial line ; a fuscous-edged orange discoidal lunule ; a subterminal rather wedge-shaped orange band hardly reaching inner margin; a terminal orange band with black line on its inner edge ; a series of black points on termen and apical spot. Hindwing with oblique antemedial brownish band ; the terminal area orange with curved black line on its inner edge and two fine terminal lines interrupted at middle by two black points on the lobe.

Habitat.—Bhutan (Dudgeon) *Exp.* 18 mill. *Type*—In B. M.

4723*a*. LUMA LONGIDENTALIS, n. sp.

Head and tegulæ white slightly mixed with brown ; palpi, patagia, thorax and abdomen yellow brown ; pectus, legs, and ventral surface of abdomen white. Forewing yellow brown with white streaks in the interspaces to the very irregularly and extremely dentate postmedial line which is defined by white on outer side, most produced below costa and between veins 5 and 3, then oblique, a terminal series of white points rather more developed at apex ; a fine dark terminal line. Hindwing yellow-brown with minutely dentate dark postmedial line defined by white on outer side ; a terminal series of white points and fine dark terminal line.

Habitat.—Bhutan (Dudgeon) ; N. Guinea, Key I. (Kühn). *Exp.* ♂ 20. ♀ 30 mill. *Type*—In B. M.

4731*a*. DIATHRAUSTODES FULVOFUSA, Hmpsn. Trans. Ent. Soc., 1901, p. 442.

♂. Palpi fuscous, white at base and tips ; frons whitish ; antennæ, vertex of head and thorax fulvous and fuscous ; abdomen fuscous tinged with fulvous ; pectus, legs and ventral surface of abdomen whitish. Forewing fuscous suffused with fulvous to the postmedial line and at apex ; a curved antemedial line ; an oblique pure white triangular patch on costa extending down to vein 5 on inner side of postmedial line which is bent inwards below vein 3. Hindwing greyish fuscous ; a dark postmedial line excurved between veins 5 and 3, then bent inwards ; cilia of both wings black at base, white at tips. Underside of inner and terminal areas of forewing and of the whole hindwing grey.

Habitat.—Khásis. *Exp.* 18 mill.

4731*b*. DIATHRAUSTODES SIMILIS, n. sp.

Palpi with tuft in front of 3rd joint ; the maxillary palpi dilated with scales.

♀. Black ; palpi with the base and 3rd joint white, tips of maxillary palpi, sides of frons and basal joint of antennæ in front white ; fore and hind tarsi and bands on mid-tarsi white ; abdomen ringed with white and with the ventral surface white except at extremity. Forewing with curved black antemedial line ; an indistinct medial line ; a wedge-shaped white patch from costa just beyond middle to vein 4 ; cilia with large white patches below apex and above tornus. Hindwing with slight white medial line, sinuous from costa to vein 3, then retracted to below end of cell ; a fine white line at base of cilia, the cilia white from vein 2 to submedian fold, then white with the bases black to vein 1.

Habitat.—Khásis. *Exp.* 20 mill. *Type*—In Coll. Rothschild.

4742*a*. PILETOCERA DISCALIS, n. sp.

♀. Head and thorax pale ochreous very strongly irrorated with dark brown; abdomen ochreous with dark brown dorsal bands. Forewing ochreous very strongly irrorated with dark brown so as to cover nearly the whole wing; a curved subbasal dark line followed by traces of another line; a waved antemedial line angled inwards in cell; a small annulus in middle of cell; a dark edged discoidal bar with its lower extremity bent inwards; the postmedial line sinuous, bent outwards and minutely dentate between veins 5 and 3 with an ochreous patch in its sinus, then retracted to lower angle of cell; a terminal series of black lunules and two dark lines through the cilia. Hindwing ochreous; a dark discoidal point; a postmedial minutely dentate line retracted on vein 2, the area beyond it tinged with fuscous; a terminal series of lunules and a dark line at base of cilia.

Habitat.—Ceylon (Mackwood). *Exp.* 24 mill. *Type*—In B. M.

4735*a*. STENIA RUBRICEPS, n. sp.

♂. Greyish fuscous; head rufous; abdomen with the ventral surface white. Forewing with dark discoidal spots; a postmedial line bent inwards at vein 4 to below end of cell. Hindwing with obscure dark postmedial line ending above tornus.

Habitat.—Dharmsala (Hocking); Tenimber (Doherty). *Exp.* 16 mill. *Types*—In Coll. Rothschild and B. M.

SCOPARIANÆ.

4754*a*. SCOPARIA INGRATELLA, Zell. Linn. Ent. i. p. 283, f. 5. (1846).

White; palpi blackish at side; thorax and abdomen tinged with yellow brown; forelegs blackish above; tarsi banded with black. Forewing irrorated with black, slightly tinged with pale brown towards base; a diffused black almost medial line, oblique from costa to median nervure where it is obtusely angled, with a small black-edged brownish spot on its outer edge in cell and a short black streak below the cell; discoidal spot figure of 8-shaped, more or less complete, brown defined by black; postmedial line diffused, black, minutely waved, slightly incurved from costa to vein 4 where it is angled outwards, then incurved; a diffused brownish subterminal band strongly irrorated with black, expanding on inner side below costa and middle and with somewhat dentate outer edge; a terminal series of black points; cilia with a series of fuscous points. Hindwing slightly tinged with fuscous especially towards termen. Underside of forewing suffused with fuscous.

Habitat.—Europe; Armenia; Syria; Kashmir, Goorais Valley. *Exp.* 20 mill.

4755*a*. SCOPARIA CROCALIS, n. sp.

♀. Head, thorax, and abdomen orange mixed with black. Forewing orange irrorated with black; the basal area suffused with black; a subbasal black spot below the cell; the antemedial line defined by black suffusion on each side of it and bent inwards to costa; a black spot in middle of cell; discoidal stigma figure of 8-shaped, defined by black; postmedial line defined by a broad area of black suffusion on each side of it, angled inwards at vein 7, excurved at vein 5, then retracted to below end of cell; a patch of black suffusion on middle of termen confluent with the suffusion beyond the postmedial line. Hindwing semihyaline ochreous.

Habitat.—Nilgiris, 6,700′ (Hampson). *Exp.* 20 mill. *Type*—In B.M.

4758*a*. Scoparia phæalis, n. sp.

Head ochreous and black, the vertex ochreous; thorax black mixed with grey; tarsi banded with black; abdomen whitish more or less tinged with fuscous on dorsum. Forewing grey, thickly irrorated and suffused with black; subbasal black spots on median nervure and inner margin; an oblique greyish antimedial line with diffused black on its outer side confluent with a black spot in middle of cell; a somewhat quadrate black discoidal spot; an indistinct grey postmedial line angled inwards at vein 7, excurved at vein 5, then retracted to below end of cell; an obscure terminal series of black points; cilia ochreous intersected with fuscous. Hindwing semihyaline ochreous.

Habitat.—Bombay (Swinhoe); Belgaum (Watson). *Exp.* 18 mill. *Type*—In B. M.

4758*b*. Scoparia polialis, n. sp.

♀. Head and thorax greyish; frons and palpi fuscous black; abdomen brownish. Forewing grey slightly irrorated with brown; some fuscous on costa and on base of inner margin; an oblique slightly sinuous antemedial brown line with point beyond it in cell; a rather irregular dark discoidal spot with mark on costa above it; the terminal area blackish with minutely dentate grey postmedial line excurved between veins 7 and 3 and connected with the middle of termen by an oblique grey striga. Hindwing pale fuscous with fine pale line at base of cilia.

Habitat.—Khásis. *Exp.* 16 mill. *Type*—In B. M.

4759*a*. Scoparia stramineealis, n. sp.

♂. Pale silky straw color; head and thorax irrorated with a few black scales. Forewing with diffused patches of black scales at base and on middle of costa, in middle of cell and in the submedian interspace; a somewhat X-shaped discoidal spot; with a patch of scales just beyond it on costa; the terminal area irrorated with a few dark scales. Abdomen and hindwing yellowish white.

Habitat.—Simla, 7,000′ (Pilcher). *Exp.* 16 mill. *Type*—In B. M.

4761*a*. Scoparia ochrotalis, n. sp.

♂. Head and thorax whitish tinged with fuscous; abdomen white tinged with pale brown. Forewing whitish tinged with pale cupreous brown; a slight black streak in base of submedian fold; a black discoidal point. Hindwing almost pure white.

Habitat.—Nilgiris (Hampson). *Exp.* 20 mill. *Type*—In B. M.

PYRAUSTINÆ.

4767*a*. MASSEPHA AMBIALIS, n. sp.

♂. White; thorax and abdomen tinged with ochreous. Forewing with the basal area tinged with ochreous, the costa black towards base; a double indistinct curved ochreous antemedial line; the medial area suffused with brownish ochreous with a black-edged white discoidal lunule with black point at its lower end; a white patch on costal area before the postmedial line which is defined with white on outer side and excurved between veins 7 and 2 where it is angled inwards; the terminal area brownish ochreous with some white marks below apex and waved dark terminal line reduced to points towards tornus; cilia white and brown. Hindwing pale brown; a white subbasal band; a black discoidal point; a postmedial white band excurved between veins 5 and 2; cilia white with a brown line through them.

Habitat.—Khásis. *Exp.* 20 mill. *Types*—In Coll. Rothschild and B. M.

4838*a*. BOCCHORIS QUATERNALIS, Led. Wien. Ent. Mon., 1863, p. 434, pl. 17, f. 1.

Black; palpi white at base and tips; sides of frons white; patagia with white stripes; pectus white in front; fore tibiæ and the tarsi banded with white; abdomen with dorsal white bands on 1st and 5th segments, lateral patches on anal segment and a ventral series of patches. Forewing with antemedial white spot below costa; a medial band from below costa to submedian fold; an oblique rather wedge-shaped postmedial band between veins 8 and 3; cilia white towards apex and tornus. Hindwing with subbasal white band from below costa to inner margin dilated at middle; a postmedial rounded spot from vein 7 to below 3; cilia white-tipped at apex.

Habitat.—Ceylon, Kandy; Bali; Amboina; Key I.; N. Guinea, Fergusson I. *Exp.* 20 mill.

4848. NOSOPHORA CHIRONALIS del. *Nagia incomitata*; the species is confined to Borneo.

4850. NOSOPHORA *triguttalis* insert *Nagia* INCOMITATA Swinh. A. M. N. H. (6) XIV, p. 205, which has priority.

4882*a*. PHRYGANODES DISCIPUNCTALIS, n. sp.

♂. Fuscous brown; palpi below, pectus, legs and ventral surface of abdomen white. Forewing with indistinct dark curved antemedial line with a point beyond it in cell; a white discoidal lunule; the postmedial line excurved and minutely dentate from costa to vein 2, then retracted to below angle of cell and sinuous. Hindwing with white discoidal spot; an indistinct postmedial line excurved and minutely dentate from costa to vein 2, then bent inwards to below end of cell and oblique; cilia of both wings white towards tornus. Underside suffused with white; the discoidal spots with black spots on their inner side; the postmedial line with black points.

Habitat.—S. Kanara, Wandei (Brodie). *Exp.* 24 mill. *Type*—In B. M.

4902*a*. DICHOCROCIS LEPTALIS, n. sp.

♂. Head, thorax and abdomen yellow; fore tibiæ banded with black; anal tuft with lateral black patches. Forewing yellow, the interspaces of discal area whitish ; three black points on basal costal area, the outermost on the nearly straight fulvous antemedial line ; a fulvous point in end of cell and discoidal bar ; the postmedial line fulvous with a black point at costa, slightly angled inwards in discal fold and at vein 2 retracted to lower angle of cell ; a diffused fulvous subterminal band with somewhat dentate edges, at vein 4 angled outwards to costa and with some whitish marks beyond it ; a fine dark terminal line. Hindwing whitish with fulvous discoidal bar ; a slightly sinuous fuscous line from lower angle of cell to inner margin above tornus ; a slightly sinuous fuscous line from costa beyond middle to tornus, slightly bent outwards at vein 2 where it is joined by a dentate diffused fulvous and fuscous subterminal band ; a fine dark terminal line ; cilia of both wings yellow at base, white at tips.

Habitat.—Simla, 7,000′ (Pilcher). *Exp.* 20 mill. *Type*—In B. M.

4916*a*. NACOLEIA ALBICILIALIS, n. sp.

♂. Head pale ochreous ; thorax grey ; abdomen reddish brown with white segmental rings, the terminal segment with black spot at base and white spot near extremity ; pectus, legs, and ventral surface of abdomen white. Forewing grey with slight dark irroration ; the costal area yellowish ; a curved antemedial black line ; a discoidal lunule ; the postmedial line nearly erect from costa to vein 5, then oblique to vein 2, where it is retracted to lower angle of cell, then slightly excurved ; Hindwing grey with dark irroration ; a discoidal black line ; the postmedial line nearly straight from costa to vein 2, where it is retracted to lower angle of cell then oblique to near tornus ; cilia of both wings black at base, their tips white, fuscous at apex, middle, and tornus ; underside whitish.

Habitat.—Ceylon, Matale (Pole). *Exp.* 16 mill. *Type*—In B. M.

4920. NACOLEIA CUPREALIS, insert (syn.) *Hedylepta vildersalis* Swinh. A. M. N. H. (7) 6, p. 213.

4922. NACOLEIA *vulgalis*, insert INDICATA Fabr. Syst. Ent., p. 640 (1775). which has priority.

4923*a*. NACOLEIA ALBIFLAVALIS, n. sp.

Very pale yellow ; palpi with the 2nd joint slightly tinged with fulvous. Forewing with obliquely curved brownish antemedial line ; a point in cell and discoidal lunule ; the postmedial line bent outwards between veins 5 and 2, then retracted to below angle of cell and slightly angled above vein 1 ; a terminal line. Hindwing with brownish discoidal lunule ; the postmedial line angled outwards on veins 5 and 2, then retracted to below angle of cell ; a terminal line.

Habitat.—Ceylon (Pole) ; Celebes ; Sambawa (Doherty). *Exp.* 22 mill. *Type*—In B. M.

4942*a*. NACOLEIA USTULALIS, n. sp.

Aplomastix ustalis—Hmpsn. Ill. Het. B. M. VIII., p. 138 ♀ nec. ♂.

Grey suffused with pale rufous ; palpi towards tips and frons black ; fore tibiæ mostly black above ; abdomen dilated towards extremity. Forewing with curved black antemedial line almost obsolete except in submedian interspace; slight black annuli in middle of cell and on discocellulars; the postmedial line excurved between veins 5 and 4, then retracted to below end of cell, sometimes with a patch of black suffusion in its sinus; a terminal series of black points. Hindwing with small black discoidal spot; the postmedial line bent outwards between veins 5 and 2, then retracted to below end of cell, a terminal series of black points.

Habitat.—Nilgiris (Cardew, Hampson). *Exp.* 26 mill. *Type*—In B. M.

4960*b*. SYLEPTA PICALIS, n. sp. (Pl. C., f. 9.)

♂. Head and tegulæ fuscous; vertex of head with a whitish patch; thorax white; abdomen white banded with black above; wings white, the veins strongly streaked with black. Forewing with the costal area black; a black spot near base of inner margin; an oblique black streak between vein 1 and middle of inner margin; a short streak below base of vein 2; spots in middle of cell and on discocellulars; the terminal third of wing black tinged with purplish grey. Hindwing with discoidal black spot; a postmedial line excurved between veins 5 and 2; cilia black and white on inner half of wing.

♀. With the white area rather more extensive; forewing with small white postmedial spots above and below vein 7.

Habitat.—Khásis. *Exp.* 48 mill. *Types*—In Coll. Rothschild and B. M.

4970. SYLEPTA *multilinealis* insert *Pyralis* DEROGATA, Fabr. Syst. Ent., p. 641 (1775), which has priority.

Larva white; head brown; thoracic segments with brown dorsal patches; terminal segments with fuscous dorsal spots; legs dark(Fellowes Wilson).

4972*a*. SYLEPTA HOMOMORPHA, Meyr. Trans. Ent. Soc., 1894, p. 462.

♀. Fulvous orange; palpi white below; fore tibiæ and the tarsi banded with fuscous; forewing with fuscous point on inner margin near base; an obliquely sinuous antemedial line bent inwards to costa, incurved in submedian fold and with slight spots on it in and below cell; a point at middle of cell and discoidal lunule; the postmedial line bent outwards and dentate between veins 6 and 3, then retracted to below end of cell and excurved again. Hindwing with discoidal bar; the postmedial line bent outwards and dentate between veins 5 and 2, then retracted to below end of cell and excurved again; both wings with dark terminal line and the cilia fuscous.

Habitat.—Ceylon, Gampola; Pulo Laut. *Exp.* 32 mill.

4976. SYLEPTA QUADRIMACULALIS insert *Nagia incomitata* Swinh. A. M. N. H. (7), VIII, p. 25 (1900) ♂ nec. ♀ (1894).

5014. GLYPHODES MARGINATA. Larva yellow with a pair of subdorsal black spots on each somite with short black streaks below them; head with a pair of black points; legs black. Pupa pale marked and streaked with red-brown (Fellowes Wilson).

5018. GLYPHODES GLAUCULALIS. Larva green, thoracic somites paler; head orange; 1st somite with conjoined dorsal black streaks, the others with clusters of black and white points and lateral spots; legs black. Pupa pale and dark brown (Fellowes Wilson).

5069.—LEPYRODES *neptis*, should stand as *pueritia* Cram., the figures on his plate being lettered wrongly and insert *Phalena* PERSPICATA. Fabr. Syst. Ent., p. 640 (1775), which has priority.

5086.—Will stand as THLIPTOCERAS VARIABILIS.

5088*a*.—THLIPTOCERAS DISTICTALIS.—Hmpsn. P. Z. S., 1899., p. 179.

♀. Head, thorax and abdomen pale reddish brown ; palpi blackish at sides, whitish below ; wings purplish brown. Forewing with two obliquely placed orange subbasal points and some diffused orange on inner margin ; a white bar across end of cell and spot below end ; the costa orange with 6 or 7 black points on it from above end of cell to the wedge-shaped subterminal band which ends at vein 5 ; termen and cilia orange with purplish points. Hindwing with some diffused orange on basal area and two spots in cell conjoined to the whitish costal area ; a medial yellow band narrowing to inner margin ; the termen and cilia orange.

Habitat.—Burma, Katha. *Exp.* 28 mill.

5117*a*. CROCIDOPHORA EXSTIGMALIS, n. sp.

Mid tibiæ of male dilated with a groove containing a fringe of long hair ; hind tibiæ with the outer spurs half the length of inner ; forewing broad without fans of scales.

Ochreous yellow ; head and base of tegulæ rufous ; palpi at base and throat white ; forelegs rufous, the tibiæ with white bands, the tarsi white except at extremity ; mid tibiæ and tarsi white ; abdomen with dorsal white segmental lines, the two terminal segments rufous with white spot on anal tuft. Forewing with the costal area rufous ; an interrupted waved dark antemedial line ; a discoidal bar ; a minutely waved postmedial line, incurved from costa to vein 5, excurved to vein 2, then retracted to below end of cell ; rufous subterminal spots above vein 5 and tornus and a terminal series of points. Hindwing with discoidal bar ; a waved dark line from vein 2 below end of cell to above tornus ; a waved postmedial line from below costa to termen at vein 1, bent outwards between veins 5 and 3 ; a subterminal line from costa to vein 4 and a terminal series of points.

Habitat.—Burma, Rangoon ; Borneo, Baram (Everett) ; Pulo Laut. (Doherty). *Exp.* 20 mill. *Type*—In B. M.

Genus *Pachinoa* insert POLYGRAMMODES, Guen. Delt. and Pyr., p. 318 (1854), which has priority. Type *prunicalis* from Brazil.

5139*a*. POLYGRAMMODES MŒRULALIS, Walk. Cat. XIX. p. 1,000.

♂. Structure of *P. thoosalis* but with the branches of basal half of antennæ considerably longer.

Yellow, palpi, above, head, thorax and abdomen dorsally, except at extremity, suffused with purplish brown ; palpi below, pectus, legs and ventral surface of abdomen white ; genital tufts black. Forewing with purplish fuscous patches at base, middle and on costa towards apex, edged with some diffused crimson and leaving some yellow on costal area before and beyond middle and on middle of inner area ; the termen yellow expanding below vein 5, so as to occupy the terminal third ; dentate purplish-red postmedial and subterminal lines bent outwards at vein 5. Hindwing yellow with a purplish-brown patch on inner area extending to near tornus; dentate postmedial and subterminal red lines angled inwards in discal fold.

♀. Abdomen and forewing more completely suffused with purple brown on the latter leaving only the yellow of terminal area.

Habitat.—Khásis. Borneo. *Exp.* ♂ 40, ♀ 48 mill.

5140*a*. POLYGRAMMODES GROSSALIS, Guen Delt and Pyr., p. 327.

♀. Head, thorax and abdomen ochreous mixed with brown. Forewing ochreous suffused with brown and irrorated with fuscous leaving some clearer ochreous before the antemedial line and beyond the postmedial; the antemedial line fuscous, oblique from costa to below cell where it is angled, then inwardly oblique and angled to inner margin; a grey-centred annulate spot in cell and annulate discoidal spot with some ochreous between them; the postmedial line oblique, strongly bent outwards and crenulate between veins 5 and 2; traces of a waved postmedial line excurved between veins 5 and 2. Hindwing ochreous yellow; a dark discoidal point; traces of an oblique postmedial line bent outwards and crenulate between veins 5 and 2; a dark subterminal line excurved between veins 5 and 2 and with dark irroration beyond it.

Habitat.—Khásis; Java. *Exp.* 46 mill.

5146*b*. POLYGRAMMODES NIGRILINEALIS, n. sp. (Pl. C. f. 35).

♀. Pale yellow; palpi and frons black at sides; fore tibæ and tarsi banded with black. Forewing with brownish streak on basal third of costa; an obliquely curved orange-yellow antemedial line; a black point in end of cell and black line on discocellulars running out to a point at lower angle, an orange-yellow line from it to inner margin angled in submedian fold; the postmedial line excurved from costa to vein 5 where it is bent outwards, then oblique and maculate; an obscure subterminal series of spots excurved from costa to vein 5; some terminal blackish points towards apex. Hindwing with black discoidal point; a postmedial line bent outwards and minutely dentate between veins 5 and 2; traces of a subterminal line.

Hindwing with veins 3, 4, 5 approximated as in *Parbattia*; the male is required to decide its exact affinities.

Habitat.—Sikhim, 1,800. (Dudgeon). *Exp.* 40 mill. *Type*—In B. M.

5152. PACHYZANCLA PHÆOPTERLIS. Larva, greenish white with green dorsal stripe, head and dorsal patch on 1st somite black; dorsal clusters of black specks and lateral spots on each somite; pupa brown (Fellowes Wilson).

5167*a*. PHLYCTÆNODES SUBVITREALIS, n. sp.

Pale brownish ochreous; palpi at sides and antennæ tinged with fuscous; fore and mid tibiæ streaked with fuscous; wings thinly scaled. Forewing with some fuscous suffusion at base; a curved diffused antemedial fuscous line; a prominent discoidal spot, the postmedial line diffused, slightly excurved from below costa to vein 2 where it is very slightly retracted; termen tinged with fuscous. Hindwing semihyaline ochreous white, the termen tinged with fuscous towards apex; cilia of both wings ochreous with a slight fuscous line through them.

Habitat.—Ceylon, Matale (Pole); Sumatra. *Exp.* 22 mill. *Type*—In B. M.

5169*a*. PHLYCTÆNODES SUBHYALINALIS, Hmpsn. Trans. Ent. Soc., 1900, p. 390.

Head and thorax white mixed with olive brown; antennæ ringed white and olive brown; abdomen white with indistinct brown bands. Forewing white thickly irrorated with large olive-brown scales; a white patch at base of inner area; the antemedial line white angled outwards on submedian fold; the medial area less thickly irrorated leaving an olive point in middle of cell, a large discoidal spot, and bands of olive on outer side of antemedial line and before the white postmedial line which is strongly excurved from below costa to vein 3; a series of short white streaks in the interspaces just before termen; a darker terminal line. Hindwing semihyaline white; the termen irregularly irrorated with dark brown, most widely at apex.

Habitat.—Syria, Jordan R.; Punjab, Cambellpore. *Exp.* 22 mill.

5170*a*. PHLYCTÆNODES CASCALIS, Swinh. Trans. Ent. Soc., 1890, p. 271, pl. 8, f. 18.

Forewing of male with the apex produced and the termen oblique, the inner area dilated towards base covering a tuft of long hair arising from base; patagia with tufts of long hair extending to beyond metathorax.

Brownish ochreous; palpi white at base below; pectus, femora and ventral surface of abdomen white. Forewing with oblique sinuous antemedial fuscous line bent outwards to inner margin; a dark discoidal point; the postmedial line curved from costa to vein 3 where it is retracted to lower angle of cell then slightly excurved. Hindwing with fuscous postmedial line angled at vein 2.

Habitat.—Burma, Mandalay, Kinyua, Thayetmyo, Rangoon. *Exp.* 24 mill.

5184*a*. NOORDA ALBIZONALIS, n. sp.

Head, thorax and abdomen deep chestnut brown; proboscis above towards base, a stripe on frons and vertex of head and paired stripes on tegulœ white; abdomen with white band on third segment; palpi below, pectus, legs and ventral surface of abdomen white, fore and mid tibiæ brown above. Forewing pale olive brown thinly scaled and with a metallic gloss; the base chestnut with a white point on median nervure; the costal area chestnut with a greenish gloss; a black point in middle of cell and two on discocellulars; a dark mark on middle of inner margin; a terminal brown band, dark at costa, bounded on inner side by a sinuous black line reduced to points towards costa and curved inwards below vein 2; a terminal series of points; cilia dark brown. Hindwing semihyaline, the area between submedian fold and vein 5 pale reddish brown; a dark red-brown apical patch narrowing to a point at vein 2.

Habitat.—Sikhim; Celebes, Palos B, Dongola. (Doherty). *Exp.* 26 mill.

Type—In B. M.

5194*a*. CALAMACHROUS STERRHALIS, n. sp.

♂. Palpi about three times length of head.

Pale ochreous; palpi at sides and shoulders fuscous brown. Forewing with the costal area dull crimson and fuscous to beyond middle; an oblique dull crimson line from apex to inner margin beyond middle diffused outwardly; the termen tinged with crimson; cilia whitish. Hindwing paler and more thinly scaled; traces of a curved crimson line with a more prominent mark on vein 2.

Habitat.—Simla, (Pilcher). *Exp.* 20 mill. *Type*—In B. M.

Genus Cybolomia.

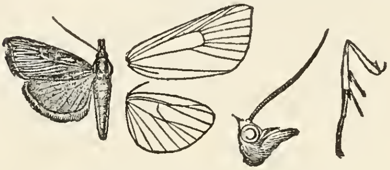
Hypolais Guen. Delt and Pyr., p. 239 (1854). proce.

Cybolomia Led. Wien. Ent. Mon. 1863, p. 420.

Type *C. pentadalis.*

Range. Neotropical region; S Europe; W. and C. Asia; N. W. India.

Palpi porrect, triangularly scaled, the 3rd joint concealed; maxillary palpi with a long pointed tuft in front; frons flat and oblique; antennæ of male lanimate; hind tibiæ with the outer spurs one-third length of inner. Forewing with veins 3,4,5 separate at origin; 7 straight and well separated from 8-9. Hindwing with veins 3,4,5 from angle of cell; 6,7 stalked, 7 shortly anastomising with 8.



Cybolomia pentadalis. ♂ $\frac{3}{2}$

5196*a*. Cybolomia pentadalis Led. Verh. z. b. Ver. Wien. 1855, p. 207, pl. 3, f. 13.

Brownish grey; sides of frons and shaft of antennæ above white; pectus, legs and abdomen whitish. Forewing with alternating black and white short streaks on costa; short white streaks in base of submedian fold, in middle of cell, and on the veins of the terminal area. Hindwing hyaline white, the termen pale brown diffused inwards along the veins; cilia brown at base.

Habitat.—Syria; Deesa. *Exp.* 20 mill.

5197*a*. Metasia coniotalis, n. sp.

Head, thorax and abdomen grey tinged with brown and irrorated with fuscous; palpi fuscous, whitish at tips, and at base below; antennæ with dark annulations. Forewing brownish grey thickly irrorated with fuscous, a somewhat oblique more or less diffused antemedial black band; a small dark spot in middle of cell and discoidal annulus; the postmedial line oblique from costa to vein 5, strongly excurved between veins 5 and 2, then retracted to below end of cell, sometimes with a diffused black patch in its sinus; a series of black points at base of cilia and usually a more or less developed fuscous patch on middle of termen. Hindwing grey irrorated with fuscous a more or less indistinct waved postmedial line excurved to near termen between veins 5 and 2; a more or less developed series of dark points at base of cilia.

Habitat.—Japan, Nagasaki (Leech); N. China, Zika-wy; C. China, Chekiang (Pryer), Chang-Yang (Pratt.); Tibet, Yatung (Hobson); Kashmir, Dras (Leech); Simla (Pilcher); Ferozpur (Nurse). *Exp.* 16-20 mill. *Type* —In B. M.

5197*b*. METASIA STRAMINEALIS, n. sp.

♂. Straw yellow; head and thorax strongly irrorated with black; antennæ annulated with black; fore legs suffused with black above. Forewing irrorated with black especially towards base of costa; a black antemedial line oblique from costa to median nervure, then incurved; a diffused black annulus in middle of cell and another on discocellulars; a minutely waved postmedial line oblique from costa to vein 5, excurved to vein 2, then retracted to below end of cell; a prominent terminal series of black points. Hindwing rather paler with a terminal series of black points; the underside with black spots in cell and on discocellulars, a postmedial maculate line excurved between veins 5 and 2, then retracted to below end of cell.

Habitat.—Nilgiris, Ootacamund (Cardew). *Exp.* 22 mill. *Type*—In B. M.

5197*c*. METASIA ANNULIFERALIS, n. sp.

Ochreous; head and thorax thickly irrorated with black; abdomen dorsally suffused with black and with whitish dorsal bands on 2nd and 3rd segments. Forewing irrorated and suffused with black, less prominently in cell and on inner area before the antemedial line, which is slightly bent outwards at median nervure; black-edged annuli in middle of cell and on discocellulars; an annulate spot on costa above end of cell with a smaller one beyond it; the postmedial line minutely dentate, arising from costa towards apex, bent outwards to near termen between veins 5 and 2, then retracted to below end of cell; a patch of black suffusion on termen below apex and a terminal series of black points; cilia ochreous and black. Hindwing ochreous with black points in middle of cell and on discocellulars; a postmedial line bent outwards between veins 5 and 2; an apical patch of black suffusion and a terminal series of points.

Habitat.—Palni Hills, Kodai Kanal (Campbell). *Exp.* 20 mill. *Type*—In B. M.

5205. PIONEA AUREOLALIS, insert (syn.) *Pionea acutangula,* Swinh. A.M.N.H. (7), viii., p. 26 (1900).

5207. PIONEA *leucanalis,* insert *Scopula* DAMASTESALIS, Wlk., xix., 1013. which has precedence.

Habitat.—Khasis. Bombay; Belgaum; Ceylon; Rangoon.

5207*a*. PIONEA ALBIFIMBRIALIS. Wlk., xxxiv., 1446.

Botys niveicilialis Snell. Midd.-Sum., iv., Lep., p. 64.

Dull pale reddish-brown; palpi at base, sides of frons, pectus, legs and ventral surface of abdomen white. Forewing with indistinct dark antemedial line oblique from costa to submedian fold, then erect; a discoidal lunule; the postmedial line strongly excurved below costa, then oblique and minutely waved; cilia black at base, white at tips, except at apex and tornus. Hindwing rather paler; an indistinct curved dark postmedial line; cilia white at tips except towards tornus.

Habitat.—China; Formosa; Ceylon, Matale; Sumatra; Java. *Exp.* 28 mill.

5207*b*. PIONEA POLIOSTICTA, n. sp.

Head and thorax pale yellow tinged with rufous; abdomen whitish. Forewing pale yellow, the veins and margins rufous; a dentate rufous antemedial line with a long tooth above vein 1; a rufous point in cell and a patch beyond lower angle with a grey spot on it; a dentate rufous postmedial line sharply angled on vein 5, then oblique to below end of cell and strongly toothed below vein 2; a minutely dentate submarginal line; a marginal series of rufous points on the veins. Hindwing white with marginal series of rufous points.

Habitat.—Ceylon, Puttalam (Pole.) *Exp.* 22 mill. *Type.*—In B. M.

5214*a*. PIONEA LONGIPALPALIS, n. sp.

♂. Palpi extending about three times length of head.

Head and thorax fuscous brown; palpi white below; abdomen grey dorsally tinged with fuscous and with sublateral series of black spots. Forewing pale reddish-brown irrorated with black; an indistinct diffused antemedial line oblique from costa to below cell where it is angled; orbicular and reniform fuscous-brown irrorated with black, the former elongate; postmedial line minutely waved, oblique and slightly incurved from costa to vein 6, then with whitish marks on its outer edge, at vein 2 retracted to below end of cell. Hindwing white, slightly tinged and irrorated with brown; a discoidal point; a curved postmedial line, somewhat angled at vein 4; a terminal series of points.

Habitat—Kashmir, Goorais Valley (Leech). *Exp.* 26 mill. *Type*—In B. M.

5214*b*. PIONEA BRYOPHILALIS, n. sp.

Palpi extending about twice the length of head.

♂. Head, thorax and abdomen grey irrorated with black; palpi white below. Forewing grey, thickly irrorated with black, an indistinct waved antemedial line; orbicular and reniform very large, grey irrorated with white and defined by fuscous, the area between them whitish; postmedial line minutely waved, curved, at vein 2 retracted to below end of cell, then excurved again, defined by whitish on outer side; a terminal series of black points. Hindwing whitish suffused and irrorated with fuscous; a dark discoidal point; a curved minutely waved postmedial line, defined by whitish on outer side; a terminal series of black points.

Habitat.—Chamba. *Exp.* 30 mill. *Type.*—In B. M.

5219*a* PIONEA NYPSIUSALIS, Wlk., Cat. xix., p. 924.

♀. Forewing of male with a large tuft of hair beyond upper angle of cell on underside.

Bright rose-pink. Forewing with obscure dark sinuous antemedial line; a dark discoidal spot; a curved minutely waved postmedial line; the costal and terminal areas brighter rose-color, the costa towards apex and cilia bright orange. Hindwing with the costal and inner areas pale; the wedge-shaped medial area pink with oblique postmedial line and its terminal area deeper; cilia orange.

Habitat.—Sikhim; Sarawak. *Exp.* ♂ 14, ♀ 16 mill.

5220*a*. PYRAUSTA EUPREPIALIS, n. sp.

Head and thorax brown mixed with olive grey; palpi below, pectus and legs brownish-grey; abdomen black with dorsal segmental whitish lines, lateral tufts towards extremity and anal tuft at sides orange, the ventral surface brownish grey. Forewing black suffused with deep crimson red, the basal area except towards costa with olive-brown; a postmedial yellowish white band expanding on inner side in discal fold; cilia dark-brown tipped with yellowish. Hindwing black; some yellowish hair towards base; an orange postmedial band broad from costa to lower angle of cell, then narrower rounded below and not reaching inner margin; cilia orange with some black at middle. Underside orange; forewing with black spots in and at end of cell conjoined to a patch below cell, a curved postmedial band not reaching costa and a terminal line; hindwing with obscure black patch at lower angle of cell, an indistinct curved postmedial line angled inwards at vein 2, the terminal area suffused with rufous.

Habitat.—Chamba. *Exp.* 20 mill. *Type*—In B. M.

5230*a*. PYRAUSTA MINIMALIS, n. sp.

♀. Head pale yellow-brown; palpi at base, sides of frons and antennæ white; thorax rufous, pectus and legs white; abdomen ochreous. Forewing ochreous, suffused with rufous so as to leave slight steaks of the ground color only; slight traces of a blackish antemedial line; a distinct black postmedial line, obsolescent towards costa, obliquely curved to vein 2, where it is slightly angled inwards. Hindwing brownish-ochreous, the cilia pale at tips.

Habitat.—Deesa (Nurse). *Exp.* 12 mill. *Type*—In B. M.

5231. PYRAUSTA MACHARALIS, del. *Scopula damastesalis.*

5252*b*. PYRAUSTA EURALIS, n. sp.

Head and thorax ochreous; palpi black, white at base; abdomen fuscous. Forewing pale ochreous; the costal area brown to beyond middle; an oblique dark line from costa before middle to middle of inner margin with some brown shading before it on inner area; a broad terminal brown band with strongly bisinuate black line on its inner edge. Hindwing pale ochreous with terminal brown band narrowing and somewhat obsolescent towards tornus and with a curved black line on its inner edge.

Habitat.—Kashmir. (Pilcher). *Exp.* 24 mill. *Type*—In B. M.

5255*a*. PYRAUSTA ATRIFUSALIS, n. sp.

Mid tibiæ of male dilated with a groove containing a fringe of long hair.

♂. Head, thorax and forewing ochreous strongly suffused with fuscous-brown; palpi below, pectus, legs and ventral surface of abdomen mostly ochreous. Forewing ochreous suffused with fuscous-brown leaving an orange yellow streak on costa before and beyond the postmedial line; the antemedial line incurved to costa; a dark point in cell and discoidal lunule; the postmedial line minutely waved, excurved between veins 6 and 2, then retracted to below end of cell; a fine pale line at base of cilia. Hindwing ochreous suffused with fuscous-brown; an indistinct waved dark line from just beyond lower angle of cell, to inner margin above tornus with some ochreous on each side of it;

a similar line from costa beyond middle to near termen at vein 2, then curved round to tornus; an obscure terminal series of fuscous and ochreous spots; the underside ochreous with dentate postmedial line excurved at middle.

Habitat.—Chamba. *Exp.* 26 mill. *Type*—In B. M.

5258*a*. Pyrausta xanthothysana, n. sp. (Pl. C. f. 4.)

♂. Forewing with large fovea below base of cell.

Reddish-brown with a cupreous tinge; palpi below, front of pectus and mid tibiæ and tarsi white; fore tibiæ with white bands. Forewing with oblique sinuous dark antemedial line; a speck in cell and discoidal lunule; a highly dentate postmedial line slightly bent outwards between veins 7 and 2, then retracted; a terminal series of black points; cilia yellow. Hindwing with minutely dentate postmedial line; a terminal series of points becoming a line towards tornus; cilia yellow.

Habitat.—Sikhim. *Exp.* 36 mill.

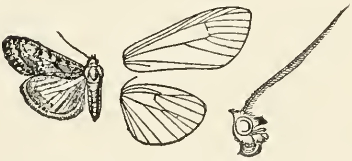
Genus—Cornifrons.

Cornifrons Led. Wien. Ent. Mon., 1863, p. 384.

Type *C. ulceratalis.*

Range.—N. America; Algeria, Syria, Persia; N.-W. India.

Palpi porrect the 2nd joint moderately scaled, the 3rd prominent; maxillary palpi long and slightly dilated at extremity; frons with long corneous process with oblique vertical edge; antennæ ciliated; tibiæ with the outer spurs two-thirds length of inner. Forewing with vein 3 from before angle of cell; 4,5 from angle; 7 straight and well separated from 8,9. Hindwing with vein 3 from near angle of cell; 4,5 from angle; 6,7 from upper angle, 7 anastomosing with 8.



Cornifrons ulceratalis ♂ $\frac{1}{1}$

5270*a*. Cornifrons ulceratalis Led. Wien. Ent. Mon., 1858, p. 147, pl. 4, f. 1.

Scoparia seriziatalis Oberth. Et. Ent. 1, p. 69, pl. iv, f. 10.

Pale brownish ochreous. Forewing slightly irorated with black scales or largely clouded with black on antemedial, medial and postmedial areas; a black antimedial spot below the cell; an oblique irregularly waved medial black line angled outwards in cell and with a spot beyond it on inner margin; a large cloudy black-edged reniform spot; the postmedial black line minutely dentate, angled outwards at veins 6 and 2, at vein 2 retracted to below end of cell, and with a diffused black and grey band beyond it; a terminal series of black points; cilia fuscous at base. Hindwing ochreous white; a minutely dentate fuscous postmedial line between veins 6 and 2; a diffused brownish terminal band; some black points on termen between veins 2 and 4.

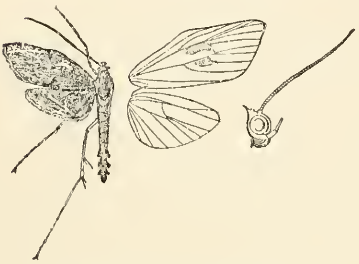
Habitat.—Algiers; Syria; Persia; Ferozpur; Deesa; Oudh. *Exp.* 26 mill.

5275*a*. Noctuelia dichroalis, n. sp. (Pl. C. f. 6.)

♂. Bright yellow: palpi slightly marked with black towards extremity; frontal prominence black at sides; patagia and thorax suffused with fuscous except in front; abdomen with the first three segments mostly black on dorsum and the next two largely marked with black. Forewing with the inner area fuscous black to beyond middle and confluent with spots on base of costa, a subbasal spot in cell, the antemedial line and spots in end of cell and on discocellulars; a postmedial series of spots, the spot above vein 5 displaced inwards, joined at vein 5 by an oblique series from apex, then oblique to near termen at vein 2, below which there is an angled mark beyond the fuscous area; subterminal points above and below vein 4. Hindwing with the basal area fuscous, its outer edge obliquely sinuous and with yellow spots on it below cell and on inner margin; a sinuous series of five spots from costa beyond middle to tornus; two conjoined spots at apex and a terminal point below vein 3.

Habitat.—Celon, Matale (Pole). *Exp.* 18 mill. *Type*—In B. M.

Genus TERATAUSTA. nov.


Teratausta odontalis ♂ $\frac{1}{1}$.

Proboscis fully developed; palpi upturned, the 3rd joint long and slender; antennæ of male simple; legs very long and slender, the spurs long, hind tibiæ with a few long scales at extremity above; abdomen very long with slight lateral tufts towards extremity. Forewing long and narrow, the costa lobed at middle, then excised; a curved elongate hyaline fovea in end of cell, and a hyaline streak below the extremity; vein 2 from before middle of cell, slender, curved; 3 beyond middle, curved at base; 4·5 from angle; 6 from well below upper angle; 7 from angle; 8·9 stalked; 10 slender approximated to 8·9; 11 sinuous. Hindwing with vein 2 from middle of cell; 3,4,5 from angle; 4,5 approximated for a short distance; 6 absent; 7 anastomosing with 8.

5277*a*. TERATAUSTA ODONTALIS, n. sp.

♂. Pale reddish brown irrorated with dark brown. Forewing with indistinct oblique dark line from the hyaline foveas to inner margin before middle; an obscure dark patch on costa extending to lower angle of cell, bounded by a sinuous white line, and with a very obscure dark line from it to inner margin, angled in submedian fold and with a dark mark with white line on its outer edge beyond it; a subterminal white line forming four extremely long and acute teeth filled in with black scales and with a black streak from it below its uppermost tooth towards termen; cilia pale with some dark spots and with black and white lines at base. Hindwing with diffused dark subbasal band and angled line beyond lower angle of cell; a slightly sinuous incurved white line from apex to tornus, angled outwards to termen at vein 2; a blackish line from termen below apex to before tornus. Underside with the markings more distinct and outlined with black.

Habitat.—Silhet, Chadkhara. *Exp.* 28. mill. *Type*—In Coll. Rothschild.

THE MOTHS OF INDIA.

Description of Plate C.

Fig. 1. *Epiplema falcata.*
„ 2. *Venilia rumiformis.*
„ 3. *Leptomiza rufitinctaria.*
„ 4. *Pyrausta xanthothysana.*
„ 5. *Venusia ochrota.*
„ 6. *Noctuelia dichroalis.*
„ 7. *Thalassodes picturata.*
„ 8. *Arichanna plagiogramma.*
„ 9. *Sylepta picalis.*
„ 10. *Epiplema nivea.*
„ 11. *Xenographia heteva.*
„ 12. *Abraxas diversicolor.*
„ 13. *Acidalia pulchrifascia.*
„ 14. *Ophthalmodes striatifera.*
„ 15. *Diatræa aculeata.*
„ 16. *Stamnodes elwesi.*
„ 17. *Pomasia sparsata.*
„ 18. *Charltona fusca.*
„ 19. *Epiplema holosticta.*
„ 20. *Boarmia biserrata.*
„ 21. *Photoscotosia chlorochrota.*
„ 22. *Chrysocraspeda croccicincta.*
„ 23. *Gymnoscelis semivinosa.*
„ 24. *Astheniodes argentiplumbea.*
„ 25. *Hydrelia aurantiaca.*
„ 26. *Hypsipyla rotundipex.*
„ 27. *Epiplema rectimarginata.*
„ 28. *Loxaspilates seriopuncta.*
„ 29. *Cidaria cymatia.*
„ 30. *Cœnodomus fumosalis.*
„ 31. *Macalla rufibarbalis.*
„ 32. *Macalla metasarcia.*
„ 33. *Oxymacaria pectinata.*
„ 34. *Thalassodes hypoleuca.*
„ 35. *Polygrammodes nigrilinealis.*

THE GAUR AND THE GAYAL.

(*BOS GAURUS* AND *BOS FRONTALIS*.)

By E. C. Stuart Baker, F.Z.S.

During the last thirteen years I have been collecting a large mass of material, with a view to trying to prove either that the gaur and the gayal are one and the same, or else that they are specifically distinct from one another. During the first two or three years of this period I held the opinion that they were identical. After this I veered round a good deal, and began to think that the reasons for considering them to be distinct might be right; this, because I quite failed to obtain certain necessary links between the two forms. The years 1897 to 1899, however, produced specimens which have shewn every one of these same links, and I am now forced to the conclusion that there is no difference of specific value between the two animals, such differences as do exist being principally, if not entirely, the result of domestication.

The question is one which has repeatedly cropped up in various papers, both scientific and otherwise, and on the 13th, 20th and 27th August and 3rd September 1898, a certain amount of correspondence again appeared in *The Field*, but no further light was shewn by this, unless it was to prove that certain characteristics, said to be typical of the one so called species, were often shewn also by the other. Colonel Pollok, who says that his "experience of the gaur has been very extensive," makes one or two slips which shew that, however extensive his experience may be, a few of the most simple of facts have quite evaded it. Amongst other things he says: "The points of all young bulls turn in like the horns of the cows, but as age creeps on this is lost." Now as a matter of fact the young bull calf has horns which do not turn in at all; they at first grow out almost straight from the sides of the forehead, later on they commence to turn up, but it is not until the end of the second year, at the very earliest, that they begin to turn in. In the second series of woodcuts, carefully reproduced from photos, I include that of a typical young bull calf (No. 2 G) above two and a half years old, which was shot by myself in 1893 in company with Mr. J. Clark, C.S. This head should be compared with No. 2 K, that of a typical wild cow, and the comparison will shew at once how widely mistaken Colonel Pollok is in his assertion.

I quite agree with Colonel Pollok in thinking that Mr. Sanderson's supposed gayal was nothing but a gaur, but in the absence of any proof to the contrary I cannot help but think that his own two supposed gayal were also nothing but gaur. In fact, it will be seen from the photographs I give that his diagnosis of his gayals would have done also for gaur. He says: "The semi-cylindric crest and concavity of the skull are wanting in the gayal." I shall shew that they are often *present* in the gayal, and on the other hand are often *wanting* in the gaur. Then he goes on to say: "It is smaller; the facial angle is all but straight." The first difference is of course merely comparative or individual, and the straightness of outline I shew from the woodcuts given to be altogether an individual and not a specific characteristic.

Now, having refused to accept other good and well known sportsmen's dictum as finally correct, it is but right that I should shew what right I have to give my own opinion, nor I do not claim that it should be accepted as final by other people though I personally consider I have proved my contentions.

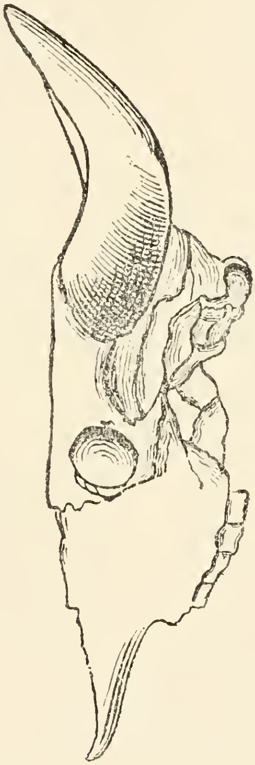
The opportunities I have had for the study of this subject have, I believe, been quite exceptional. North Cachar, which is on the extreme north-eastern frontier of India, is situated between the Naga Hills, Manipur, Looshai and certain plains districts, and is in the very heart of the domesticated gayal country, Kukies, Nagas and other hill tribes keeping them in great numbers. The gaur, or wild form, is also extremely plentiful in suitable localities throughout this and the adjoining districts, and during the time I was stationed in North Cachar I shot fifty-four bulls, four cows and the one calf mentioned above.

After leaving North Cachar I was transferred to Dibrugarh, the most Eastern District of Assam, where I have now been three years and where the observations I have made have confirmed those previously made in North Cachar.

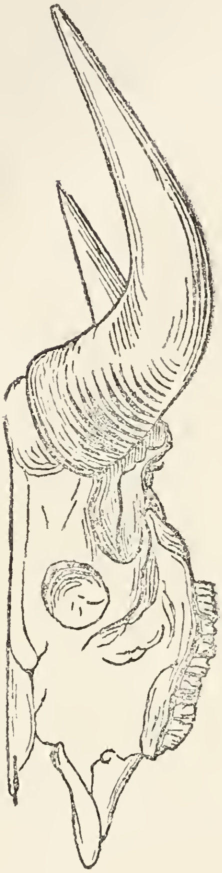
The greater part of the time I was in North Cachar I lived within a couple of hundred yards of a village which kept a large herd of tame gayal, and I have taken every opportunity of examining other herds.

I should, I think, mention that once long ago I shot a bull which shewed all the most typical characteristics of the tame animal; this at the time I fully believed to have been a wild animal pure and simple, but afterwards I received information which led me to think that it was merely a very surly old tame bull which had belonged to a Kuki, but had left the herd and gone off on his own account some two years prior to my shooting him.

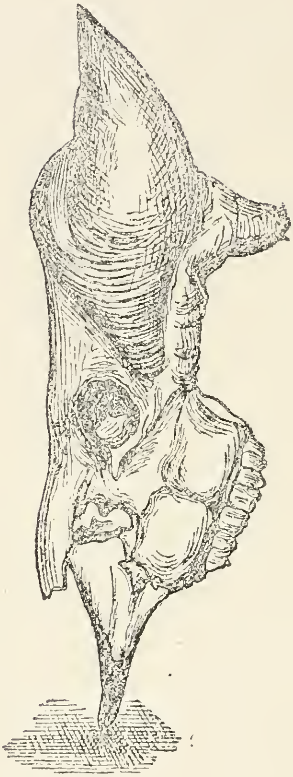
The first series of illustrations give the side views of certain skulls of both wild and tame animals, and shew the first point about which there is any controversy, *viz.*, the shape of the forehead, and also certain other points which I shall discuss, but, before doing so, will give details as to the heads themselves.



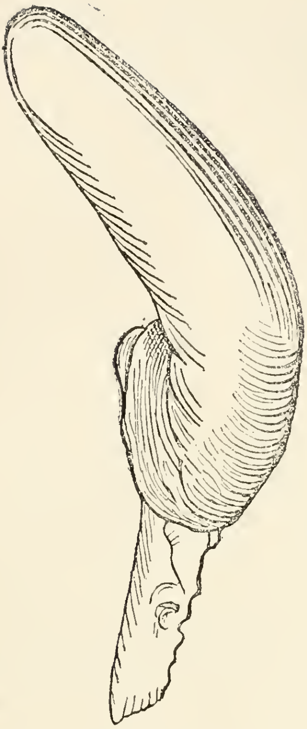
(*a*) *Tame Cow.*—This is the head of a cow which belonged to a large herd kept by a village in the Kuki country to the west of the Jetinga river. Its sire was one of the tame bulls, but I cannot trace its parentage further back. The surrounding country contains numerous wild gaur, the bulls of which used to visit regularly and cross with the tame cows.



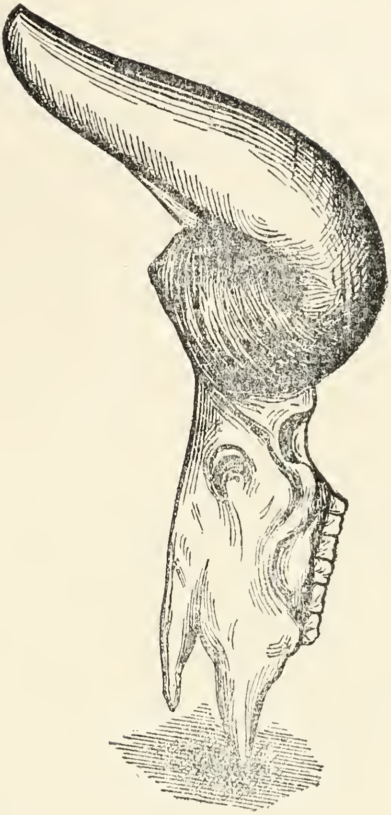
(*b*) *Wild Bull.*—This was a fine young wild bull shot in the Mikir country to the north-west, where there are no tame herds at all, and the bull could not possibly have had any taint of tame blood. I should think this bull was about five years old.



(*c*) *Very old Tame Bull.*—This has been photographed with the horns removed from the cores, so as to shew, as plainly as is possible, the outline. This bull came from a Kuki herd near which there are no wild gaur and had, for many generations, been sired by domestic bulls only.



(*d*) *Very old Wild Bull.*—Shot by me in the Mikir country previously referred to. This was the biggest bull I have ever killed or seen and stood 19 hands 3 inches between uprights. It was very old and very gaunt and decrepit.



(*e*) *Old Wild Bull.*—Shot in the Jetinga Valley, where it kept constantly on the move between the various tame herds.

Now, according to scientists, one of the principal differences between the two forms is, that whereas the gaur (*Bos gaurus*) has the forehead deeply concave, the gayal (*Bos frontalis*) has it more or less convex.

As soon, however, as I began to study the matter I saw at once that this point was utterly worthless. Of course it cannot be denied that the majority of heads of *Bos gaurus*, the wild animal, have the head concave, still many have it only very slightly so and some not at all. As to the tame form (*Bos frontalis*) it is, however, quite the exception for the forehead to be really convex ; the greater number have it more or less straight in outline ; many have it more or less concave and some old bulls have it deeply so.

An examination of the woodcuts will shew that though (*a*), a tame cow, has the forehead the most straight (not even this is really convex) of the whole series, yet there is very little difference between this and the young wild bull's head (*b*) ; on the other hand (*c*), an old tame bull, has the forehead very deeply concave, the inward curve being far in excess of the amount shewn in *most* wild bulls' heads. The head (*e*) shews the extreme limit to which this point ever goes. Between the wild head (*b*) and the tame head (*c*) every grade of concavity may be found both in wild and tame animals. Bulls, as a rule, shew a greater concavity than do cows, and the straightest outline I have ever found in a bull, wild or tame, is that shewn in (*b*) ; (*a*) and (*c*) have now been made over to the Asiatic Museum.

The next point, as shewn by the side view, is the facial angle with reference to the nasal bones. This is one, which, strange to say, is seldom dwelt upon by naturalists, and yet is the one which I have found the hardest to dispose of.

The wild animal has almost invariably the nasal bones turning downwards from their junction with the prolongation of the frontal bone ; the tame animal seems almost as often to have them either quite straight or even slightly bending outwards from the same junction. I succeeded in getting both animals with quite straight nasals, but it was a long time before I could obtain any which shewed the shape actually contrary to what it should have been according to rule ; (*b*), however, shews a wild head with practically straight nasals, while (*c*), the old tame bull, shews them well turned inward.

A point which does not appear in the woodcuts, but upon which stress is often laid, is the colour of the horn. This in the tame form is said to be wholly black and in the wild form more or less tinted with reddish horn over its greater portion, and tipped black. As a matter of fact, it is very exceptional to find a tame animal with horns black throughout, nearly all being to some extent tinged with reddish or greenish horn at the bases, and I have seen one or two tinted with greenish horn throughout three-quarters of their length. *Inter se*, wild animals also vary greatly in the colouration of their horns. My record head is that of a magnificent bull which I shot on the 1st of January 1893 ; these horns are a bright reddish only tipped with black. Another head, which I saw, of a bull shot in a trap by Kukies within a few miles of the same place is green practically throughout, the black tips, which I imagine originally existed, having been almost entirely worn out.

After the head points already referred to, and which are shewn more or less in the drawings, there remains only the facial angle of the lower part of the head to be dealt with from a side view, and this is one which has to be studied from the living animal; of course this depends almost entirely on the shape of the nasal bones, and from what I have already written it will be seen that normally the wild animal shews a ram-nosed profile, and the tame much the same side view as that of an ordinary cow. Whereas, though the latter seldom shews much variation, the former varies extremely. One of the first gaur I ever shot was a huge bull, which I came upon very suddenly as it stood grazing in a sea of grass some four feet high. I was enabled to get very close before firing, and my attention was at once drawn to the very remarkable ram-faced profile it exhibited, the more so that I had the previous day shot another bull, the angle of whose face appeared quite straight. A third bull, which had been grazing with the ram-nosed one, but which I did not get until the following morning, did not have the ram-nose half so developed. I have, therefore, come to the conclusion that the variation shown in this respect is merely individual, and is of no specific value.

The principal characteristic, as shown by the next series of drawings, is the shape of the crest or vortex of the skull as it lies between the horns. It is one on which great stress is laid by naturalists and sportsmen, but which is shown by this series to be of no value whatsoever. According to the hitherto accepted theories the gayal or tame form never has any signs of the cylindrical crest, which is, on the other hand, invariably present in the gaur or wild form. I can find no trace of any record of wild animals, reported as gaur, which have not been credited with this cylindrical crest and, *vice versâ*, I can find none of so called gayal, wild or tame, which have been said to have it. Blanford mentions, "Mammalia of India," p. 487, *et seq.* a skull of the gaur obtained in the Mishmi Hills which wants the frontal cavity, but no mention is made of the absence of the cylindrical crest.

The same author (in *loc. cit.*) says : " A few days before these pages went to press I saw, in Mr. Hume's private collection, a typical skull of *Bos frontalis* obtained by Mr. W. Davison in Tenasserim, and distinctly identified by him as that of a wild animal."

Of this head, however, Blanford gives no details beyond saying that it was typical, and we must, therefore, presume that there was no cylindrical crest. The evidence accordingly on this point must depend solely on what is shown in the following heads. To refer, therefore, to them : Looking at the head which shews the straightest line *a*, we should expect this at once to be that of a tame animal ; instead of that it is that of a wild one, and that not a cow but a bull, and from this the crests will be found to be bigger and bigger in a regular gradation until we come to *h* which is that of a tame bull, and this shews a crest, drawing to almost a point in the centre and far more highly developed than in nine out of ten wild animals. The conclusion that I have arrived at, after the careful inspection of a huge amount of material, is that the extent of the crest is entirely an individual characteristic. In both wild and tame animals its complete absence is rare, more especially in males, and the crest in old animals is more developed than in the young, and again *on an average* the wild form has a higher, more cylindrical crest than the tame. As, however, the specimens vary very greatly *inter se*, and the tame one often has it more highly developed than many wild ones have, the characteristic is of no specific value.

The only other point shewn by the photographs is the growth of the horns. This is the point which Blanford uses as a key to the species. He says :—

" *Bos gaurus*—horns turned inwards near the tips."

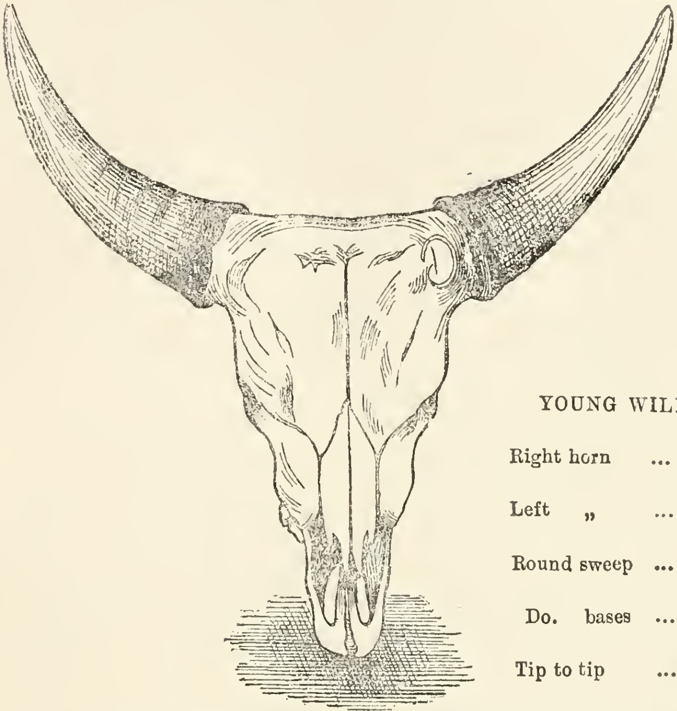
" *Bos frontalis*—horns spreading, not turned inwards."

This key at once falls to the ground when we examine *a* in the above series. Now this was a fine young, wild bull shot in the Mikir country, far from any tame herd, so that he could not possibly have been the result of a cross. Moreover, no wild cow would ever accept the services of a tame bull when, as is *always* the case, those of a finer, stronger wild animal were available.

This skull I consider a most important one, as, together with its non-incurving horns, it shews, as already noted, so flat a crest and forehead.

So far I have never been able to obtain a specimen of a tame animal with incurving horns, but the fact that a wild animal should have been

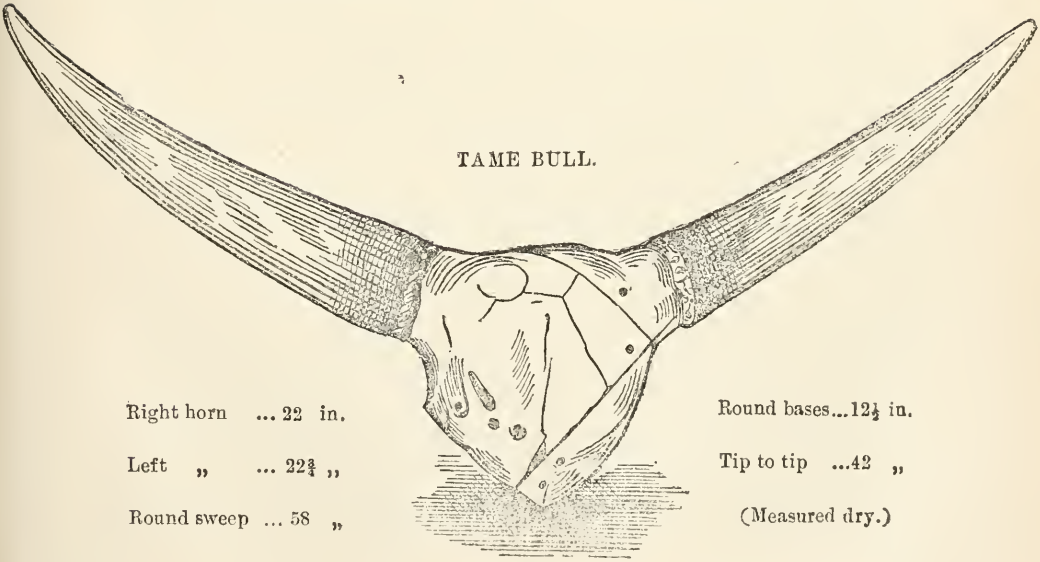
The following series of photographs gives a view of the skull front standpoint. They are of the following animals :—



YOUNG WILD BULL.

Right horn	... 18	inches.
Left „	... 18⅜	„
Round sweep	... 48¾	„
Do. bases	... 15¼	„
Tip to tip	... 29⅝	„

(*a*) Same as (*b*) in the first series, a young wild bull.



TAME BULL.

Right horn	... 22	in.
Left „	... 22¾	„
Round sweep	... 58	„

Round bases	...12½	in.
Tip to tip	...42	„

(Measured dry.)

(*b*) Is that of a tame bull.

shot with horns similar to those of the tame form bridges over this difference between them, and does away with its specific value.

This disposes of the head points, and such as can be shewn by photographs of skulls and horns.

Of the other variations said to be specific between the tame and the wild forms the one most often mentioned, perhaps, is the presence or the absence of the dewlap.

Mr. W. B. Tegetmeier, in *The Field* of August 27th, 1898, refers to this at some length, and comes to the conclusion that there is, from what is recorded, no decided opinion on the subject, but that different observers of different individual animals have given different opinions, thus showing that it is the individual and *not* the species which vary.

The various opinions I can collect seem to be the following :—

Roxburgh says *re* the gayal : " The dewlap is deep and pendent."

Dr. Trail : " The presence of a dewlap distinguishes it (the gayal) from the gaur."

Jerdon says that the gaur has the skin of " throat loose giving the appearance of a dewlap," whilst the gayal has a " small but distinct " dewlap.

Col. Pollok found no dewlap in the *two or three* he examined.

A. T. Martin, writing to Mr. Tegetmeier, described the dewlap of a full grown bull gaur as " a large dewlap, covered with coarse black hair, hanging down to a little below the knees."

Blanford gives the presence of a dewlap as a distinctive feature, but he quotes from others, and does not seem to give the distinction as one ascertained beyond all doubt.

Personally I feel sure that the absence or presence of a dewlap is individual, but that wild animals *as a rule* have it less developed than in the tame, and that both forms sometimes have none at all. The heaviest dewlap I have ever seen, either in a tame or wild animal, was that possessed by the ram-nosed wild bull which I have already mentioned. In this animal it was a distinct hanging dewlap, descending from beginning of the throat well down the breast to the forelegs, between which it dwindled away to merely a loose fold of skin on the upper chin, and between the radial bones of the cheeks it was nothing more than rather loose skin which could be gathered up in the hands.

In the tame animal this loose skin of the throat and intercheeks is often more highly developed than it was in this bull, and it then hangs in two well-defined drops of dewlap, which, however, usually ceases on the throat. In no tame animal have I seen such a hanging pendulous dewlap as this wild bull possessed on throat and breast.

Some tame bulls possess no signs of a dewlap beyond the loose skin of the intercheeks which is not often quite absent.

I have been able to draw no connection as suggested by Demosthenes (*Field*, August 20th, 1898) between the shape of the horns and the existence of a dewlap. The bull with the heavy dewlap was an enormous brute (19 hands 1 inch between two pegs placed at foot and at shoulder) with one whole horn and the stump of the other. It had a head much like that of the young bull shewn in *a*, the second series, but with a still wider sweep and less upright horns. I gave the head away before photographing it, or it would have been shewn as one of the typical wild heads which yet had horns more widely divergent at the tips than elsewhere.

The old bull whose head is shewn as *j* had a thin fold of loose skin all down his throat which, had he been in good condition, might have developed into a pendulous dewlap, but the poor brute was very thin and bony.

As regards size there is of course an enormous difference, but even this is nothing when compared with the little Bengali draught buffalo and the huge wild bull.

As to the size itself, everything depends on the way the measurements are taken. The proper way is to place a peg at the heel of the forefoot and another at the shoulder and draw a string straight between them, not touching the carcase, which would give it a curve, greatly increasing the height. Measured thus the biggest I have ever shot stood 19 ·hands 3 inches, and seemed to stand far higher than any other I have seen, though four of these measured 19 hands 1 inch.

The late Major Priestly shot one in North Cachar, which he stated to be 21 hands, and which doubtless was so according to his measurement, but my trackers who were with him when he shot the animal in question said it was not nearly so tall a brute as the one I measured 19 hands 3 inches, though it was far more bulky. Some one, Col. Pollok I think, records a Burmese bull shot by him as 21 hands, but the Burmese and North East Indian animals are probably much the same, though Southern Indian specimens may run smaller. The cows stand, I should say, in their wild state, 16 hands at the outside, occasionally a barren cow reaching 17 hands. Col. Pollok here also gives Burmese cows a height of 19 hands.

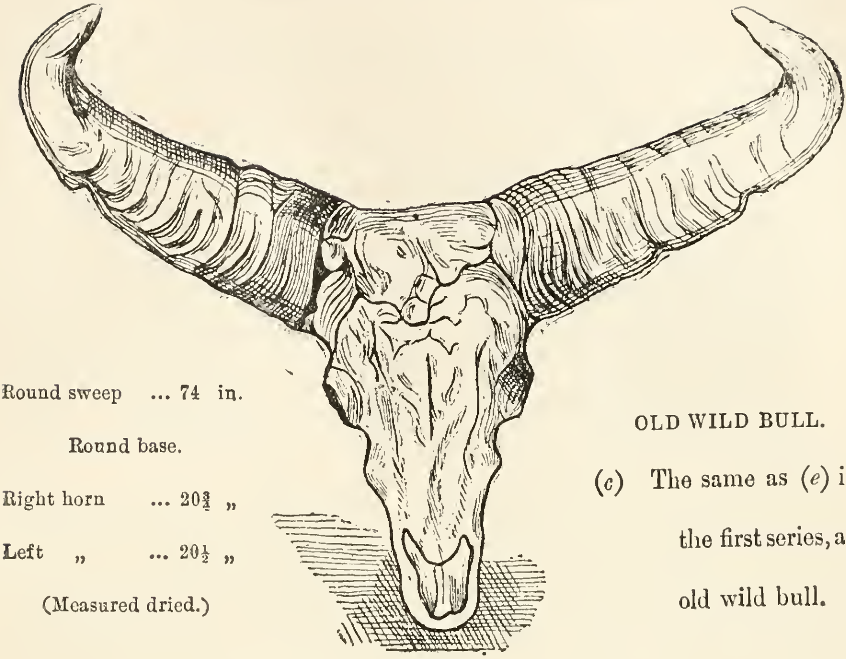
The tame form is very much smaller than the wild; a big bull may run to 16 hands 2 inches, possibly a little more though I think not; cows are probably seldom over 14 hands, but specimens are sometimes seen nearly if not quite 15.

There is yet another point which has been used by some writers to differentiate their so-called two species, and this is the formation of the dorsal ridge. This they say is shorter in the gayal than in the gaur, less developed, and does not end so abruptly. I have noticed no regular variation at all in this and can point out no difference. The wild animal is of course a bigger *far more* muscular brute than the tame, and doubtless his dorsal ridge is, with all his other parts, more developed than it is in the tame, but I can determine no structural difference whatsoever, nor do I think any such exists.

As regards the name methna, this is the one by which the animal, both in its wild and tame form, is known practically throughout the North-East Frontier, from Sadya and Dibrughur, throughout Assam, Manipur, Looshai and down to Chittagong. The word is, I think, nothing more than a corruption of the Cachari word *mithang*, which means "the muscular animal" from *mi* (मि)=animal and *thang* (থাং) = strong or muscular. This is applied alike to the tame and to the wild animal by the Cacharis merely with the prefix *hagrani* (হাগ্রানি)= of the jungle, to the wild animal and *noni* (নোনি)=of the house, to the tame. Looshais, Kukis, Nagas and other hill tribes all have their own names for the animal, and in nearly all cases it is the same for both.

In colour, comparing the two forms, age for age and sex with sex I can make no discrimination between the two, but if any such does exist it may be in the wild form retaining the chestnut colour of immaturity for a longer time than does the tame.

I may mention here that there is in the Hon. W. Rothschild's fine museum at Tring a specimen of what is called a gaur. The colour of the skin is quite a bright chestnut, and the size is not greater than that of a two-year-old bull gaur with which age the colour of the skin corresponds. The horns are those of a very small but old wild bull.



Round sweep ... 74 in.

Round base.

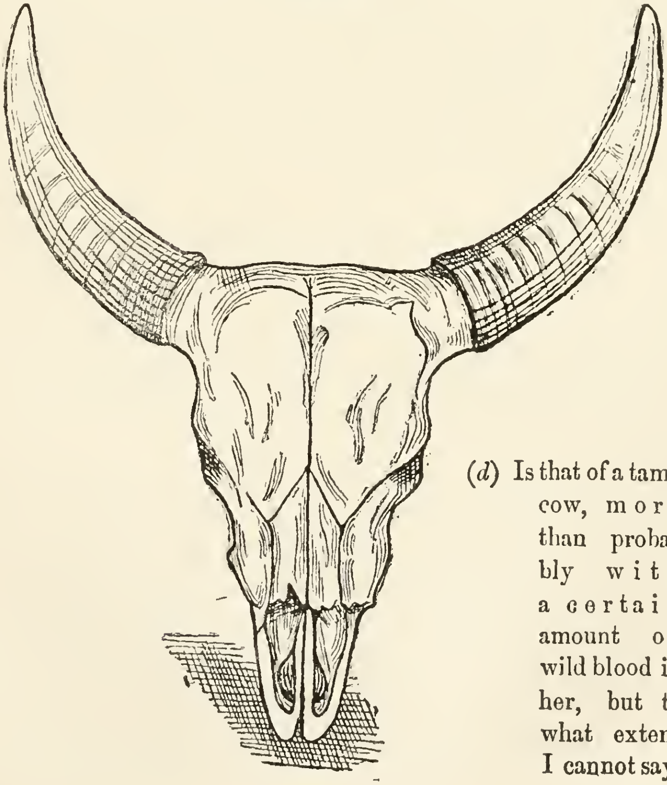
Right horn ... $20\frac{3}{4}$ „

Left „ ... $20\frac{1}{2}$ „

(Measured dried.)

OLD WILD BULL.

(*c*) The same as (*e*) in the first series, an old wild bull.



(*d*) Is that of a tame cow, more than probably with a certain amount of wild blood in her, but to what extent I cannot say.

If Indian this must be a calf's skin put to an old head, but it is probably a Malayan form, the pale coloured one, which has lately been specifically divided from our *Bos gaurus.*

The typical colour of the adult animal, gaur or gayal, is a very deep purple brown, practically black ; the old cow gets quite as dark as the old bull eventually, but retains the chestnut brown colour until nearly three years old, after which she gradually gets darker and darker.

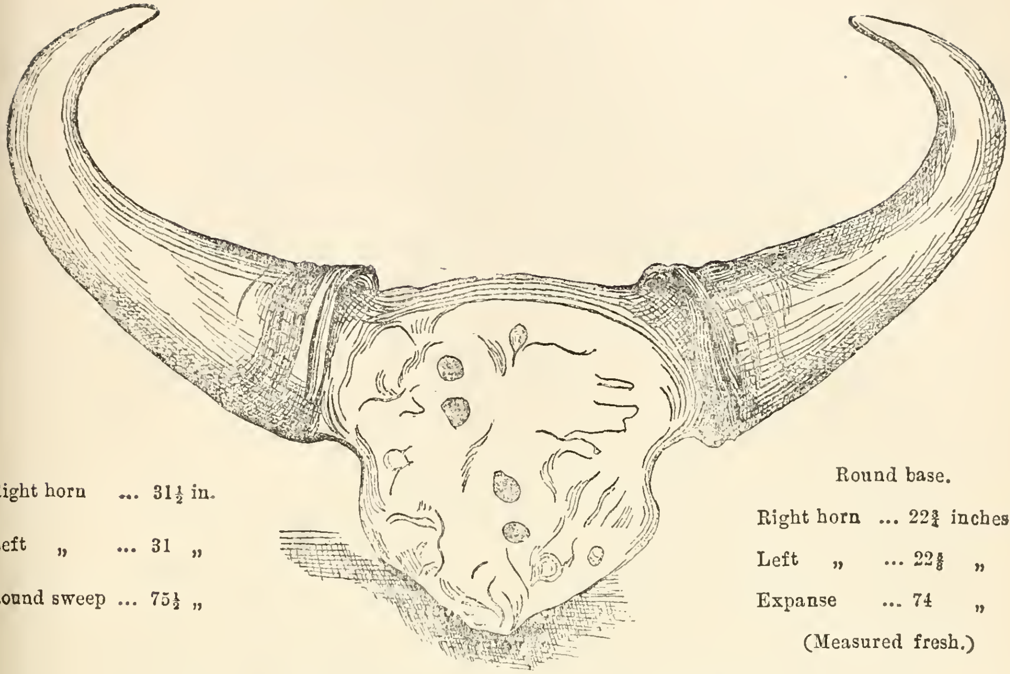
Now, as regards the domestication of the gaur, a good deal has been said and written about it, which has its foundation on a story which was started by McRae, quoted by Lambert and after him by many others. Blanford, in the volume of "Mammalia," quotes me rather as if he considered I supported this statement, so I must go into some detail over it.

McRae's story was to the effect that the Kukis found out a place much frequented by some herd of gaur, where they scattered salt about. At first, the salt being scattered, the Kukis departed out of sight, but gradually they shewed themselves and by slow degrees made the gaur so tame that eventually they accepted salt from their hands, and following them home to their villages, became domesticated.

Now this wonderful story is, I am sure, like the historical romance, fiction founded on fact. I have lived amongst the Kukis thirteen years, speak their language thoroughly, talk, shoot and go about with them, yet never have I heard one word to lead me to believe that such domestication ever took place. I have inquired also about the Looshais and others, but with no more success, and to anyone who knows the gaur well, the story can hardly seem within the range of possibility.

Probably the story arose from the following custom : The Kukis are a semi-migrant race, constantly shifting their villages from one site to another, and to each new site they have to induce their tame gayal to follow.

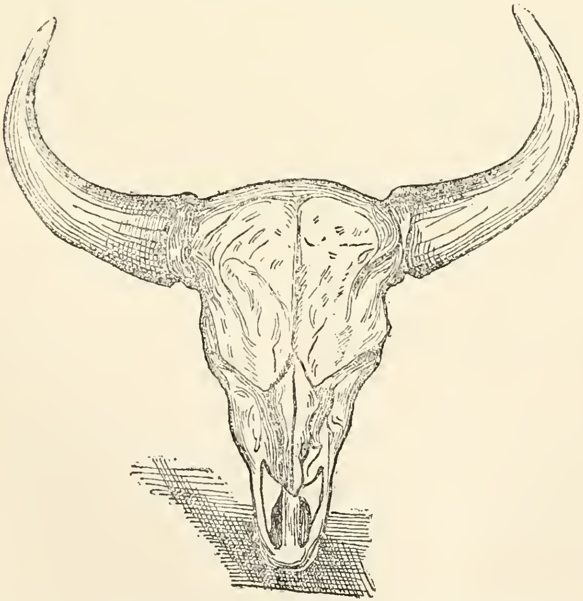
Now the gayal or methna seems to be an animal which attaches itself to places rather than to people, so that when the old village is burnt down, instead of meekly following their owners to the new village, they constantly return to the site of the old one, where they stay the night. The Kukis come in the morning, and by giving them salt, of which they are passionately fond, gradually induce them to follow them home, and once they get used to their new surroundings they, as a rule, return each night to the village and sleep there.



Right horn ... 31½ in.
Left „ ... 31 „
Round sweep ... 75½ „

Round base.
Right horn ... 22¾ inches.
Left „ ... 22⅝ „
Expanse ... 74 „
(Measured fresh.)

(*e*) A very large wild bull shot in the Jetinga Valley; as a rule solitary, but sometimes joined by a younger, smaller bull and often visiting the tame herds in the vicinity.



(*f*) A young wild bull from the Jetinga Valley.

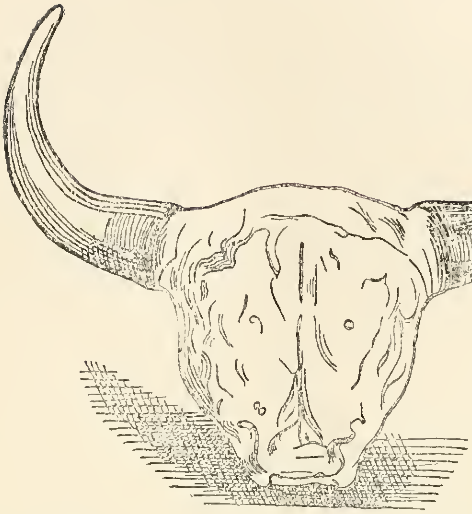
Sometimes, however, the methna wander off again to the site of the old village, although it may be overgrown with jungle, and then the same process of leading them back by the inducement of offerings of salt has again to be gone through.

Rarely—very rarely—a young feral gaur may be caught by the Kukis or Nagas and brought back to their villages, hand-reared and then turned out amongst their tame animals. I have seen two or three such, but all of them were wild in the extreme, and bolted as soon as they saw me distinctly ; whereas many of the village animals would allow themselves to be handled. The only difference they show, as far as I can make out, to those reared naturally in a wild state, is their comparatively very small size.

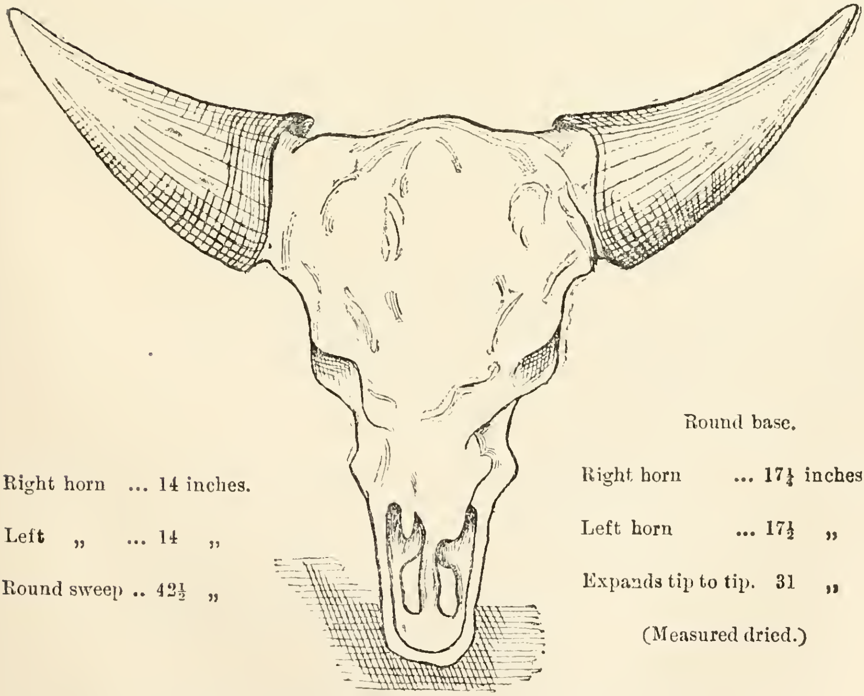
Several herds of methna are kept by the tribes in North Cachar, which contain no full grown bull, the young males being all killed off for sacrifices by festivities, etc., before they reach the age of three years. In these cases the tame herds are regularly visited by the wild bulls, and nineteen out of twenty of the calves born in them are the progeny of wild bulls and tame cows, the young in almost every instance resembling the latter and not the former. It is, however, very noticeable that such herds as are much visited by wild bulls contain animals of a bigger, robuster build than such as are habitually served by tame ones, often young and undersized animals. Strange to say the typical variations of the wild form seem seldom to be transmitted to their progeny, and it is the female parent which would, in this species, appear to stamp its form on the young. The variations, therefore, and connecting links between the two forms are found quite as often amongst those herds which have no connection with wild animals as amongst those which have much.

Photograph *b* in the second series is of an animal which in the great length of horn, large size and bulky muscle, shewed a growth attributable, most likely, to its wild blood ; on the other hand, the forehead was unusually straight, and there was absolutely *no* concavity in the forehead.

Photos *c* of the first series and *h* of the second is a head which I obtained from a Kuki raja living on the borders of Manipur. This man and his herd of methna I have known well ever since I came here thirteen years ago, and never have I known a wild bull to visit it or even to haunt the vicinity. The village has been settled some twenty years in its present site, and prior to that had been about twenty years



(*g*) Young wild bull calf. This shows the typical shape of the calf's horns, and should be compared with (*k*) to shew the difference between them.



Right horn ... 14 inches.
Left „ ... 14 „
Round sweep .. 42½ „

Round base.

Right horn ... 17¼ inches.
Left horn ... 17½ „
Expands tip to tip. 31 „

(Measured dried.)

(*h*) An old tame bull; the same as (*c*) in the first series.

more in a place only about three miles distant. The Kuki, who is quite an old man, says he inherited the herd from his father, and never either know himself or had heard of wild bulls serving the cows. This same bull, as I have already pointed out, shews the high cylindrical crest and deeply concave forehead said to be typical of the wild gaur alone; yet this bull, if any, was descended for generations from domestic animals, both on the male and female sides.

I have not dwelt upon the fact that the domestic form is so often found with abnormal white patches; once, indeed, there was a pure white bull in the herd of the Kuki rajah mentioned above, because variation in colour and deviation from that of the original stock is admittedly the usual sign of domestication, still, as such abnormal colouring adds, if it has any weight either way to the argument that the tame is derived from the wild form, the fact that it does occur should not be passed over.

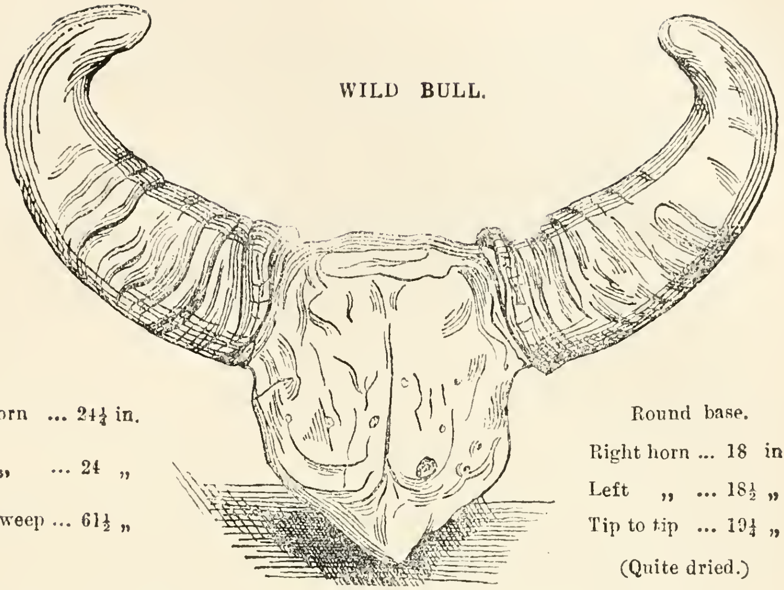
I do not know where Col. Pollok shot his two wild animals which he refers to as gayal, but I can find no trace whatsoever of anything resembling a wild specimen of the tame from anywhere in Assam, Manipur, Chittagong, Tipperah, or Northern Burma, or again in the hills to the north-east of Assam and east of Thibet. All sportsmen, who have seen the wild animals of any of these parts, assure me that it is the gaur pure and simple, though many of my informants point out that they have noticed variations of some slight degree in facial angle, colour and shape of horns, &c., which, however, when one has shot a good many, all prove to be individual and not specific.

To sum up the alleged differences they come to this :

The wild form known as *Bos gaurus*, the gaur of sportsmen, is : (1) a big animal ranging up to 21 hands ; (2) has a large cylindrical crest ; (3) the forehead deeply concave ; (4) the nasals receding ; (5) the horns incurved, and the greatest divergence not at the tip ; (6) no dewlap ; and (7) constant colouration.

The tame form known as *Bos frontalis*, the gayal, is on the other hand : (1) much smaller, rarely if ever exceeding 17 hands ; (2) has no cylindrical crest ; (3) has a straight or actually convex forehead ; (4) has the nasals, when taken in a line with the forehead, somewhat protruding ; (5) the horns growing straight out from the sides of the head, not incurving, but widest apart at the extreme tips ; (6) a dewlap and (7) variable colouration.

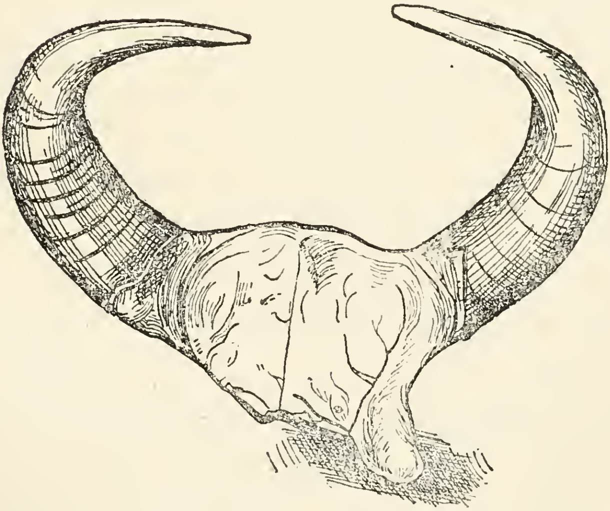
Taking these points one by one it has been shewn that (2) whereas the tame form often has the crest more or less developed, and some-



Right horn ... 24¼ in.
Left " ... 24 "
Round sweep ... 61½ "

Round base.
Right horn ... 18 in.
Left " ... 18½ "
Tip to tip ... 19¼ "
(Quite dried.)

(*j*) Very old wild bull: same as *d* in the first series.



(*k*) An old wild cow.

times highly cylindrical, yet, on the other hand, the wild form sometimes has it quite straight; (3) this has been shewn by the photos. to be a matter of degree in both wild and tame forms, both possessing individuals whose foreheads shew straightness and varying degrees of concavity; (4) this also is shewn by the photographs to be an individual characteristic, and that it is so is also said to be the case by Col. Pollok; (5) examination of the photos. shews here also connecting links throughout, and it will be observed that in this case it is amongst the wild forms that most of the links are shewn; (6) in this point I have had to give my personal experience to shew that it is an individual characteristic, but I am supported in what I have written by the many recorded observations of naturalists and sportsmen who, each giving their own personal view of the matter, shew, by the wide divergence of their opinions, that there is every degree of dewlap to be found in different specimens, from the smallest to such as are of some size; whilst in some, many perhaps, there is none at all.

With regard to points 1 and 7, size and variation of colour, it will probably be admitted by everyone that these are so essentially matters of domestication that they need not be considered.

Finally, although it has nothing to do with my arguments, or anyone else's as to the difference or non-difference of the two species, yet it may be of interest if I close my article with a note on some measurements of horns of the two forms.

Such of the measurements as I cannot guarantee to be correct I place in brackets, the others I vouch for being absolutely correct.

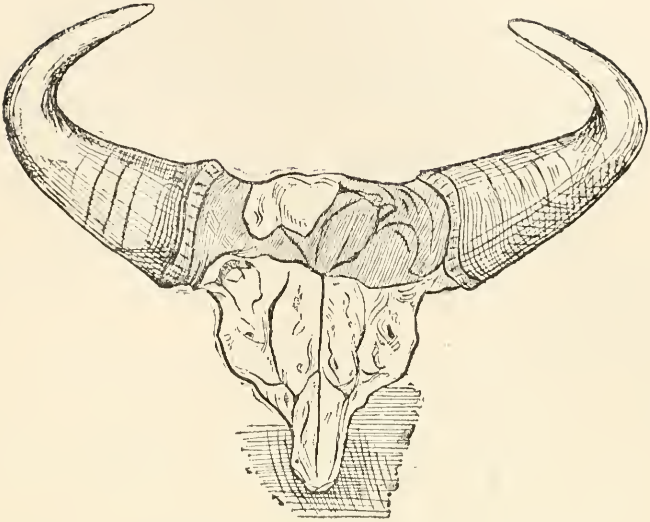
Of my wild heads the finest I consider to be that shewn as *e* in both series. The measurements are as follows:—

Tip to tip round sweep	75½	inches.
Base of right horn in girth	22¾	„
„ left horn	22⅜	„
Greatest expanse	47	„

Measured ten days after being shot.

Another longer but lighter head measures:—

Tip to tip round sweep	86½	inches.
Base to tip of right horn	37	„
„ „ left horn	37½	„
Girth of right horn at base	19½	„
„ left „	19¼	„
Greatest expanse	53	„



(*l*) A wild bull shot in the Makir country.

These two represent the stoutest and longest horns, respectively, I have ever seen and were both shot by myself.

Another very fine head which was killed in a gun trap and brought to me by a Kuki and is now in the possession of Mr. F. Bott, measures—

Tip to tip round sweep ...	... 74	inches.
Girth of right horn at base ...	... 20¾	„
„ left „ „ ...	... 20½	„
Widest expanse about ...	... 56	„

This was measured dry, and would probably have measured close on 22 inches round the bases of the horns if measured fresh. I have known no head with such a magnificent expanse as this one showed, though one or two have approached it rather closely.

Of tame animals the following are the best measurements I have taken. The bull marked *c* in the first series and *h* in the second measured—

Round sweep from tip to tip	... 42½	inches.
Length of right horn ...	... 14	„
„ left „ ...	... 14	„
Girth of right horn at base ...	... 17¼	„
„ left „ „ ...	... 17½	„
Tip to tip of horns, straight...	... 31	„

Another bull I measured which was very similar in general shape to the last measured—

Round sweep from tip to tip ..	... 48	inches.
Length of right horn ...	... 17¼	,,
,, left ,, ...	... 17	,,
Girth of right horn at base ...	... 15	,,
,, left ,, ,, ...	... 15	,,
Tip to tip in a straight line ..	... 33	,,

The young bull shewn as *b* in the second series would probably have become in two or three years an abnormally fine specimen. Young as it was it then taped—

Round sweep from tip to tip	... 58	inches.
Length of right horn ,,	... 22	,,
,, left ,, ,,	... 22¾	,,
Girth of right horn at base ...	... 12½	,,
,, left ,, ,, ...	... 12½	,,
Tip to tip in a straight line ...	... 42	,,

A cow marked *a* in the first series, a specimen rather above the average, was as follows :—

Round sweep	... 41	inches.
Right horn	... 15	,,
Left ,, ...	... 16	,,
Girth at base	... 10½	,,
Tip to tip	... 25¾	,,

The horns first mentioned in these measurements are bigger round the base than any others I have seen and *measured*, but one which I saw in a Naga village on a sacrificial pile was much stouter, as well as longer, and this, I should think, would have measured close on 19 inches round the bases. The Nagas, however, refused to sell it, and I had no tape then to measure it with. I have seen none, as far as I remember, which were purely of the domestic type, with horns as long as those marked *b*.

THE BIRDS OF TRAVANCORE,
By H. S. Ferguson, F.L.S.,
WITH NOTES ON THEIR NIDIFICATION,
By T. F. Bourdillon, F.L.S.

THE BIRDS OF TRAVANCORE.

The plate belonging to this paper will appear with Part II., in the next number of the Journal.

Editor.

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According to Colonel Legge the connection between the ornis of the Himalayas and that of Ceylon is but slight and only what one would expect in mountain districts of adjacent ornithological regions, and this is pretty much the opinion of Mr. Blanford who remarks that "though it contains several Himalayan genera and species they are not sufficient to enable South Indian and Ceylonese areas to be classed with the Himalayan forest area in a separate sub-division or sub-region."

There is a decided affinity with the Burmese fauna evidenced by the existence of such genera as *Loris* and *Tragulus* among Mammals, *Draco* among Reptiles, *Ixalus* among Amphibians, and *Lyncornis*, *Hemicircus* and *Gorsachius* among Birds.

So far as bird life is concerned Travancore may be divided into four districts : (1) the forest-clad hill range from the south up to and includ-

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(*With a Plate*).

Part I.

Travancore was, no doubt, covered with forest at one time from the coast to the summit of the hills, the watershed of which forms the boundary between it and British India. The luxuriance of the vegetation is due to the fact that the country gets the full benefit of both monsoons, for the soil is poor. Under the influence of the heavy rainfall and a strong sun there is an abundant vegetation which teems with insect life, and in consequence there is a rich avifauna consisting of some 326 species. So far as I am aware the only contribution towards its description is a "First List of the Birds of the Travancore Hills" by Mr. F. W. Bourdillon which appeared in "Stray Feathers" in 1876. In this ninety species are mentioned, and in a "Second List," which appeared in the same journal in 1878, twenty-eight more species were recorded. I shall quote freely from them to supplement my own information.

As would naturally be conjectured the ornis of Travancore is very closely related to that of Ceylon. That of its hill range corresponds to that of the south-western hill regions of Ceylon, while that of the extreme south of Travancore corresponds to that of the north and north-west of Ceylon.

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So far as bird life is concerned Travancore may be divided into four districts : (1) the forest-clad hill range from the south up to and including the Cardamom Hills with an average height of 4,500 feet; (2) the Kanan Devan Hills or high range, more open in character and with an average height of 6,500 feet; (3) the low country except the extreme south; (4) the low country about and within twenty miles of Cape Comorin.

The First District.

The chain of hills for the first half of its length, that is from Cape Comorin to the Achankovil Gap, rises rather abruptly from the level of the low country and consists merely of a single ridge with outlying spurs. Its average height is 4,100 feet, and only two of the peaks reach 5,000, Agastia being 6,200 feet, while Mahindragherry is 5,500. The first forty miles of the range from Cape Comorin are known as the Ashambu Hills and include the second of the two peaks mentioned. The next part is not known by any general name, but includes Agastia (6,200 feet), Chimunji (4,800 feet) and Ponmudi, a grass hill (3,500 feet high). It ends at the Ariankavu Pass 1,210 feet high. About eight miles further north is the Achankovil Pass about 1,470 feet high; a strong ridge 2,000 feet to 3,000 feet separates the two valleys. From base to summit the hills of this part of the range are covered with a dense growth of evergreen forest, and there is very little grass, in fact it only grows on some of the outlying spurs and on the more exposed ridges. In some instances, too, land which had been under forest and had been cleared for coffee cultivation is now overgrown with grass. From the Achankovil Pass the ridge gradually rises and widens till it forms at an elevation of 3,100 feet, a tableland of forest which stretches for about fifteen miles and is known as the Panthalam Hills. Its character then changes, and there is instead of continuous forest a grass-covered plateau with scattered patches of forest at about the same elevation; this district is known as Pirmerd, and here there are many tea estates. This plateau extends some forty miles to the Cardamom Hills. These are clothed again with forest, and there is a continuous chain of cardamom gardens. It is a most beautiful part of the range, as all the grand old forest trees are left standing and only the undergrowth and smaller trees are cleared away, so that you can walk for miles in more or less open forest and can see for a considerable distance on either side of the path. It is a great place for birds, and one of the few where the great Black Woodpecker is commonly seen. In the Assambu Hills the rainfall is from 80 to 100 inches, at Ponmudi it is 180, and at Pirmerd it is over 200. All over this part of the range bird life is pretty uniform. One meets with numbers of such forms as *Irena puella*, *Chloropsis jerdoni*, *Arachnechthra minima*, *Alseonax latirostris* at low elevations and *Dendrocitta leucogastra*, *Eulabes religiosa*, *Hypsipetes ganeesa*, and others common to the western ghâts higher up. It includes one bird which is peculiar to it, namely, *Trochalopterum meridionale. Rhopocichla bourdilloni*, peculiar to Travancore, is found throughout the range, including the Kanan Devan Hills.

The second district, which comprises the Kanan Devan Hills or high range, is of a more open character and at a higher elevation. Looking at it from the Cardamom Hills, it appears to run at right angles to these hills and to tower above them. As a matter of fact, the main range runs north and south; but there are high spurs running east and west, and it is one of these that one first sees. Here again there is plenty of grass land, and much of the forest has been cleared for tea cultivation. Its average height is 6,500 feet, and its rainfall varies from about 104 to well over 200 according to aspect. The birds peculiar to it are *Trochalopterum fairbanki*, *Cisticola erythrocephala*, *Phylloscopus affinis*, *Carpodacus erythrinus*, *Anthus nilgiriensis*, *Galerita malabarica*, *Cypselus melba*, *Microperdix erythrorhynchus* and *Gallinago nemoricola.* I have not taken these elsewhere in Travancore. The distribution of the first of these genera, *Trochalopterum*, is very instructive. The range of *T. meridionale* extends from the extreme south as far as the Achenkovil Gap. On the High Range *T. fairbanki* takes its place and extends to the Anamallais and Palnis, which are practically the same range though British territory.

The Neliampathis, which are in the native State of Cochin, are connected with the Anamallais and the High Range by a ridge of a more or less horse-shoe shape. This part of the hills is, I believe, the habitat of Davison's Laughing Thrush (*Trochalopterum cinnamomeum*). There is then a distinct break in the range, which is known as the Palghat Gap. This sharply divides the Neliampathi Hills from the Wynaad and Nilgiris. In the former *Trochalopterum jerdoni* is found and in the latter *T. cachinnans.* The distribution of the genus *Merula* is much the same. *M. bourdilloni* is found from the extreme south as far as the Palnis. The habitat of *M. erythrotis* will, I think, be found to be the Neliampathi Hills. *M. similima* is also found on the Palnis, but more often on the Nilgiris, while *M. nigripileus* is found there and also in Mysore. I have made this digression and pointed out these facts, as there are some mistakes in the volumes of the

"Fauna of British India" Birds, where the Palghat Hills are said to be in Travancore and the Anamallai Hills in S. Travancore, whereas the former are in Cochin and the latter chiefly in British territory, only a small portion lying within Travancore in the extreme north.

The third district, the low country, excepting the extreme south, is neither flat nor undulating, but may be described as hummocky, consisting as it does of a number of low hills divided by narrow valleys in which rice is usually grown. These hills are still covered with small trees and undergrowth, and in many places serpent groves, of some half acre or so in extent, are left where the old forest still remains. At one place especially, called Kutyani, about 8 miles from Trevandrum, a much larger extent of the old forest has been left standing, and here I have obtained many birds which are elsewhere found only on the hills, and also the small dusky striped squirrel (*Sciurus sublineatus*), which is not usually met with below 2,000 feet elevation. Nearer the sea there is a belt of cocoanut cultivation and there is a chain of fresh-water lakes connected by canals which forms a waterway running north and south throughout the whole length of the country. Here, of course, is the home of numerous water birds, mostly migrants. The rainfall at Trevandrum, 50 miles from Cape Comorin, is sixty-five inches, distributed as follows :—33 in the South-West monsoon (the middle of May to the middle of September), 23 in the North-East monsoon (middle of October to middle of January), and 8 only in the dry months, from the middle of January to middle of May; 40 miles north of this at Quilon it is 62, 29 and 8, beyond this such forms as *Pyrrhulauda grisea* and *Cursorius coromandelicus* do not extend, as the rainfall increases gradually till at Alleppy, 40 miles north, it is 70, 37 and 13 in the same periods. The usual west-coast forms, such as *Iole icterica*, *Tephrodornis sylvicola*, *Xantholœma malabarica*, are common.

The fourth district, the low country about and within twenty miles of Cape Comorin, is flat. It is the rice-growing district of Travancore, and the rainfall is only 25 inches. The palmyra here takes the place of the cocoanut palm. It is this district which, as I have said, corresponds with the northern region of Ceylon and with the Carnatic. Here only in Travancore are found among Mammals the South Indian Hedge-hog (*Erinaceus micropus*), among Reptiles *Gongylophis conicus* and *Eryx johnii*, and among Birds *Lanius vittatus*, *Munia malabarica*, *Francolinus pondicerianus*, *Neophron ginginianus*, *Turtur cambayensis* and *Turtur risorius*.

From the beginning of September to the end of April many migrants may be found in the hills and the low country. The following is a list of the chief migratory species that visit Travancore :—

Larvivora brunnea.
Acrocephalus stentorius.
Do. dumetorum.
Locustella straminea.
Arundinax œdon.
Hypolais rama.
Phylloscopus affinis.
Acanthopneuste nitidus.
Do. viridanus.
Do. magnirostris.
Do. occipitalis.
Lanius cristatus.
Oriolus indicus.
Do. kundoo.
Pastor roseus.
Sturnia blythii.
Alseonax ruficaudus.
Do. mutui.
Geocichla wardi.
Do. cyanonotus.
Petrophila cinclorhyncha.
Do. cyanus.
Carpodacus erythrinus.
Hirundo rustica.
Motacilla alba.
Do. melanope.
Limonidromus indicus.
Anthus maculatus.
Pitta brachyura.
Cuculus canorus.
Asio accipitrinus.
Circus macrurus.
Do. cineraceus.
Do. melanoleucus.
Do. æruginosus.
Buteo desertorum.

Falco perigrinus.
Do. severus.
Rallina superciliaris.
Chettusia gregaria.
Charadrius fulvus.
Ægialitis geoffroyi.
Do. mongolica.
Do. alexandrina.
Do. dubia.
Hœmatopus ostralegus.
Numenius arquata.
Do. phœopus.
Totanus hypoleucus.
Do. glareola.
Do. ochropus.
Do. stagnatilis.
Do. calidris.
Do. glottis.
Tringa minuta.
Do. subarquata.
Do. alpina.
Scolopax rusticola.
Gallinago nemoricola.
Do. cœlestis.
Do. stenura.
Do. gallinula.
Larus icthyœtus.
Do. ridibundus.
Do. brunneicephalus.
Do. gelastes.
Do. affinis.
Hydrochelidon hybrida.
Hydroprogne caspia.
Sterna anglica.
Do. media.
Do. fluviatilis.
Nettium crecca.
Querquedula circia.

In addition to the migrants other birds usually residents in the plains are found during the hot months at considerable elevations on the hills.

Centropus sinensis, *Upupa epops*, *Artamus fuscus*, *Oriolus melanocephalus*, *Pycnonotus hæmorrhous*, *Thamnobia fulicata*, *Terpsiphone paradisi* are examples. The breeding season for most birds is from April to June, but nests may be found in almost every month of the year. For notes on nidification I am indebted to Mr. T. F. Bourdillon almost entirely and, where possible, I have supplemented them from my own observations. For five years I collected in the hills, *viz.*, from 1875 to 1880; since then I have collected in the low country and have only been able to pay occasional visits to the higher elevations. I have also employed a collector both in the hills and the low country.

FAMILY—CORVIDÆ.

Sub-family *Corvinæ*.

(1) CORVUS MACRORHYNCUS.—The Jungle Crow.

Oates, No. 4; *Jerdon, No.* 660.

The Jungle Crow is found commonly all over the country. In South Travancore it does not frequent the hills, but on Pirmerd, where there is open grass country, it is common. It nests in the hills and also in the low country, the breeding season being April to June.

(2) CORVUS SPLENDENS.—The Indian House Crow.

Oates, No. 5; *Jerdon, No.* 663.

This crow is common everywhere. The Public Gardens in Trevandrum are a happy hunting ground for it, and unless care is taken it manages to get the food meant for the animals kept there in captivity. It matters not whether this is fish, flesh or fruit—it is all the same to this insatiable robber. Pierre Loti's description of them is most apt. "Crows, everywhere crows, India is infested with crows . . . and even here, in Travancore, in this land of peace and enchantment, their cries, as soon as the day begins to silver the scene, fill the vault of palms to check with a shiver the joy of all who live and who waken under this glorious greenery. They say 'we are here, we, who are waiting for the corruption of all flesh, and our food is certain and we eat everything. . . .'" Mr. T. F. Bourdillon writes: "They build in May, and I have even seen them commence in March, but I don't think they ever lay before June. The nest is placed on trees and is composed of sticks lined with wool, rags or hair. The usual number of eggs is four, and they are greenish-blue, speckled and marked with brown and raw sienna. The eggs are often elongated. The shell is slightly glossy, and fine for the size of the bird. Average size is 1·40×1·04." I have taken the eggs as early as February in the Public Gardens, Trevandrum, where the towers of the museum are a favourite site for nests.

(3) DENDROCITTA RUFA.—The Indian Tree-pie.

Oates, No. 16 ; *Jerdon, No.* 674.

The Indian Tree-pie, though common in the low country, does not seem to be so bold a bird here as it is described to be in North India. It frequents gardens, but I have never known it to enter a verandah of a house. It breeds during the South-West monsoon. It does not ascend the hills.

(4) DENDROCITTA LEUCOGASTRA.—The Southern Tree-pie.

Oates, No. 17 ; *Jerdon, No.* 678.

This very handsome bird occurs in numbers from the foot of the hills to about 3,000 feet always in forest, going about in parties of three or four, which make their presence known by their noisy cries. "Its eggs may be obtained in March and the beginning of April at elevations of 2,000 to 3,000 feet above sea-level. The nest is small for so large a bird, and is not domed ; the interior diameter is 3 inches or so. It is placed at 12—15 feet from the ground, usually in thick forest, sometimes on a sapling, sometimes in a larger tree. Three seems to be the usual number of eggs, cream-white in colour, profusely speckled and blotched with ashy and yellowish-brown markings, more abundantly towards the larger end ; the shell is glossy and fine."—*T. F. B.*

Average of 3 eggs 1·13×0·85.

Sub-family *Parinæ.*

(5) PARUS ATRICEPS.—The Indian Grey Tit.

Oates, No. 31 ; *Jerdon, No.* 645.

The Indian Grey Tit is said to be found throughout the whole of India alike in the hills and plains. In Travancore it is never to be seen in the plains. It is occasionally to be met with at the foot of the hills, and is not uncommon at the higher elevations, especially about 3,000 feet, and I have shot it on the high range at 6,000 feet. "It wanders about in small parties of four or five individuals."—*F. W. B.*

(6) MACLOLOPHUS HAPLONOTUS.—The Southern Yellow Tit.

Oates, No. 43 ; *Jerdon, No.* 648.

This tit is abundant from about 3,000 feet to the summit of the hills. Mr. F. W. Bourdillon says "it is often found in company with the foregoing," *i.e., Parus atriceps.*

Family—CRATEROPODIDÆ.

Sub-family *Crateropodinæ.*

(7) Garrulax delesserti.—The Wynaad Laughing Thrush.

Oates, No. 75 ; *Jerdon, No.* 409.

Flocks of these birds may be found in thick underwood at all elevations throughout the range. They are a noisy crew. Mr. F. W. Bourdillon says of them :—" A flock sometimes numbers as many as twenty individuals, which feed a good deal on the ground, and when disturbed utter loud shrill chattering notes of alarm." Mr. T. F. Bourdillon writes :—" I once found the nest of this bird placed in a tuft of grass at a height of four feet from the ground, and composed of grass roots and fine stems of grass. It was rather a deep cup and contained three very glossy blue eggs indistinguishable from those of *Crateropus griseus.* Unfortunately I left the nest intending to bring my gun and shoot the bird next day, but on coming to the spot on the following morning the nest was empty." The bird breeds in June.

(8) Trochalopterum fairbanki.—The Palni Laughing Thrush.

Oates, No. 96.

Oates gives the distribution of this bird as " The Palni and Anamallai Hills in South Travancore above 3,000 feet." As I have already pointed out, the Palni and Anamallai Hills are altogether in British territory. The bird is however found in Travancore, but in the north and not in the south. It is common at 5,000 feet and above on the Kanan Devan Hills, or high range, the highest peak of which, Anaimudi, is the centre from which spring the Anamallai on the north and the Palni Hills on the east. Elsewhere in Travancore it is not found.

(9) Trochalopterum meridionale.—Blanford's Laughing Thrush.

Oates, No. 97.

This bird is found only in South Travancore at the summits of the hills above 3,500 feet. I have not taken it north of the Achankovil Gap where it occurs. It is found in numbers going about in small scattered parties. It is by no means a shy bird, and may be seen climbing about the trees searching the leaves for food, and often descends to the ground. In addition to the usually chattering notes it utters when disturbed, it has a clear whistle of some ten notes which may be heard all day. Its nest has not been taken, but as I shot a young bird in March just out of the nestling plumage, I conclude that the breeding season is about May and June.

(10) ARGYA SUBRUFA.—The Large Rufous Babbler.
Oates, No. 108 ; *Jerdon, No.* 437.

Oates gives the distribution of this Babbler as "the Western Ghats from Coonoor and Kotagiri on the Nilgiris to Khandala near Bombay." It is, however, fairly common on the hills throughout Travancore down to the extreme south. It frequents thick jungle, but the secondary growth in old abandoned coffee clearings is a favourite resort for it.

(11) CRATEROPUS CANORUS.—The Jungle Babbler.
Oates, No. 110 ; *Jerdon, No.* 434.

The Jungle Babbler is common at the foot of the hills. Oates remarks that " it appears to ascend the hills to about 5,000 feet of elevation or probably higher in the south." I have not found it anywhere but at the foot of the hills in South Travancore ; but I got one specimen at about 4,000 feet on the high range in the north.

(12) CRATEROPUS GRISEUS.—The White-headed Babbler.
Oates, No. 111 ; *Jerdon, No.* 433.

This bird is fairly common in the plains, and especially so about Cape Comorin. It breeds in June. Mr. T. F. Bourdillon writes :— "The eggs vary from three to five in number. They are pretty regular cylindrical ovals, excessively glossy, spotless and of a deep greenish-blue, much deeper than the eggs of any of the other Malacocirci. They vary in length from 0·9 to 1·0 and in breadth from 0·62 to 0·74."

(13) CRATEROPUS STRIATUS.—The Southern Indian Babbler.
Oates, No. 112 ; *Jerdon, No.* 59.

This is by far the commonest of the Babblers in the south. It breeds in April and May.

(14) CRATEROPUS SOMERVILLII.—The Rufous-tailed Babbler.
Oates, No. 113 ; *Jerdon, No.* 435.

I include this in my list of Travancore birds on the strength of the specimen mentioned by Oates as having been procured at " Kollachal in Travancore." I have not come across it myself.

(15) POMATORHINUS HORSFIELDII.—The Southern Scimitar Babbler.
Oates, No. 120 ; *Jerdon, No.* 404.

This is a common bird from about 2,000 feet upwards, and may sometimes be found lower than this. It is more frequently heard than seen, as it is very shy and frequents thick underwood. Mr. F. W. Bourdillon describes it as " common at all elevations," but this is not my experience. He further adds :—" It builds a large wove nest of grass and rattan leaves placed beneath some overhanging bank or tuft of grass, or occasionally in some thick bush." Mr. T. F. Bourdillon writes :—"It breeds at elevations of from 2,000-4,000 feet in January, February and March. It always prefers the thick forest, but the only two nests I have found were placed by the side of a road. The nest is large and domed and composed of grass and eerul leaves and a good deal of moss. The eggs, three in number, are white with very thin shells, resembling in texture the eggs of swifts or martins. In shape they are fusiform, the transverse axis running through the centre of the egg and not towards one end."

The average size is 1·0 × 0·75.

Sub-family *Timeliinæ.*

(16) DUMETIA ALBIGULARIS.—The Small White-throated Babbler.

Oates, No. 136 ; *Jerdon, No.* 398.

Small parties of these birds may commonly be met with from 1,000 to 3,000 feet elevation in thick underwood. They are shy birds and require to be looked for. Colonel Legge says they are common in the low country in Ceylon. In Travancore this is not the case, and I have found them nowhere below 1,000 feet in the hills. Travancore birds resemble Ceylon specimens in having the white feathers of the throat white shafted, differing in this respect from Mysore and Wynaad ones ; they are however of a much duller hue of fulvous below, and there is no tinge of rufous on the head and forehead which are dark-ashy. The white on the throat also is not nearly so conspicuous, and is in fact merely whitish and the upper plumage is darker.

(17) PELLORNEUM RUFICEPS.—The Spotted Babbler.

Oates, No. 144 ; *Jerdon, No.* 399.

Mr. F. W. Bourdillon writes :—"This bird appears to be scarce. I have only obtained a single specimen in thick underwood at an elevation of 2,500 feet." It is certainly rare, as I have also only obtained a single specimen on the Cardamom Hills at 3,000 feet. This was in January, 1901. There were two feeding on the ground just off the road.

(18) ALCIPPE PHÆOCEPHALA.—The Nilgiri Babbler.

Oates, No. 164 ; *Jerdon, No.* 389.

This babbler is fairly common at an elevation of 2,000 feet and upwards. On the high range it is perhaps more abundant than elsewhere. Mr. T. F. Bourdillon says :—"The nest is one of the commonest found in our jungles. It is a neat little cup lined with fine roots resembling horse hair, placed without any attempt at protection in saplings or bushes from 4 to 8 feet from the ground, and in passing through the thick jungle at elevations of from 2,000 to 4,000 feet in April and May the nest is continually met with. The usual or rather invariable number of eggs is two. The ground colour reddish-pink, with blotchings and markings of red and darker shades of the ground colour.

The average size is 0·8 × 0·6."

(19) RHOPOCICHLA ATRICEPS.—The Black-fronted Babbler.

Oates, *No.* 166 ; *Jerdon*, *No.* 390.

I have only taken this bird at elevations of 2,000 feet and upwards. It is not so common as the next species ; but is found sparingly throughout the hill range which it ascends to 4,000 feet.

(20) RHOPOCICHLA BOURDILLONI.—Bourdillon's Babbler.

Oates, *No.* 167.

This babbler is found only in Travancore where it is common throughout the whole of the hill range. It goes about in small parties and frequents the underwood, uttering a low chattering continually. It is perhaps more frequently met with at about 2,000 feet, but I have shot it at 6,000 feet on the High Range and also at Kutyani in the low country eight miles from Trevandrum. Mr. T. F. Bourdillon writes :—" I once had the nest of this bird brought to me with the bird itself and have since twice taken the nest myself. In the last instance the nest was placed within two feet of the ground and was a domed structure not unlike that of *Ochromela nigrirufa*, but in addition to the exterior frame of woven eerul leaves, there was a lining of very fine roots. Both nests contained a couple of eggs, one pair being slightly incubated. This bird builds at rather high elevations, *viz.*, from 2,000 feet to the summit of the hills, and prefers the outskirts of the forest unlike *A. phæocephala* which always builds far in. The breeding season is from March to May. The eggs are white, sparingly spotted with purplish-brown over most of the egg, but at the top the spots form a zone.

Size 0·75 × 0·52."

Sub-family BRACHYPTERYGINÆ.

(21) MYIOPHONEUS HORSFIELDII.—The Malabar Whistling Thrush.

Oates, *No.* 189 ; *Jerdon*, *No.* 342.

The inconsequent but mellow notes of this thrush, which have earned for it the name of the drunken plough-boy, may be heard in the neighbourhood of running water at all elevations in the forest-clad hills. Mr. F. W. Bourdillon says :—" I have known this species to build on ledges of rocks and in a hollow tree overhanging a stream, in either case constructing a rather loosely put together nest of roots and coarse fibre with a little green moss intermixed. The female lays two to four eggs in April, and both birds assist in the incubation."

Mr. T. F. Bourdillon writes :—"The Malabar whistling thrush builds a firm compact nest exactly resembling an English black-bird's or thrush's nest, and chooses a site always close to water. I have found many nests and this is the invariable rule. Sometimes it is on the ledge of a rock in midstream. Some times year after year the parents return to a crevice in a rock on the river bank, and sometimes a hole in a tree 15 or 20 feet from the ground is chosen. But whether in heavy jungle, or in a coffee clearing, or on a grass hill there is always water to be found close at hand. The breeding season is April and May, and the number of eggs is usually three. The colour is a very pale greenish-white with light green and red spots sprinkled all over it, especially at the larger end where they generally run together and form a cap. The ground colour recalls that of one type of the English jay's eggs. The average size is 0·95 × 1·25."

(22) Larvivora brunnea.—The Indian Blue Chat.

Oates, No. 191 ; *Jerdon, No.* 507.

The Blue Chat is only a visitor to South Travancore where it may often be seen feeding on the paths in open forest on the hills from about 1,000 feet elevation. It is a shy and silent bird and does not now appear to be as common as it was some years ago.

On the high range I have obtained it as late as May ; it may therefore possibly be a permanent resident as it is on the Nilgiris.

(23) Brachypteryx albiventris.—The White-bellied Short-wing.

Oates, No. 193.

This is a very shy bird and has to be looked for as it frequents dense undergrowth in the forests at elevations over 3,000 feet. Oates says it is found from 1,000 feet upwards, but I have never seen it as low as this. Towards dusk it may often be met with feeding on the ground at the side of a road. Most of my specimens have been thus obtained. It is not confined to South Travancore, but is found throughout the whole range.

Sub-family *Sibiinæ.*

(24) Zosterops palpebrosa.—The Indian White-eye.

Oates, No. 226 ; *Jerdon, No.* 631.

This is one of the commonest birds on the hills from 1,000 feet upwards, but more especially so at high elevations. I have never met with it in the low country. They go about in small parties and keep up a continuous twitter as they search the leaves for their insect food, assuming all sorts of attitudes as they creep among the branches and cling in any position. The building season is April and May, and the nest is found at all heights from the ground. One I took at 4,000 feet elevation was on the side of a cutting in the road. It is found throughout the range.

Sub-family *Liotrichinæ.*

(25) ÆGITHINA TIPHIA.—The Common Iora.

Oates, No. 243; *Jerdon, No.* 467.

The Iora is common in the low country about gardens. I have not met with it in the hills. Its presence may always be known by its note which sounds like a prolonged plaintive indrawn whistle on "A" sharp falling to a short note on "F" sharp. Travancore males have a good deal of black about the back at all seasons, and in summer the black extends throughout the upper plumage, with the exception of the wings. I have taken nests in April in the Public Gardens.

(26) CHLOROPSIS MALABARICA.—The Malabar Chloropsis.

Oates, No. 248; *Jerdon, No.* 464.

Mr. F. W. Bourdillon describes this as "a common bird in open jungle with large trees. The male makes an attempt to sing, uttering a few notes, something like those of the Bronzed Drongo (*Chaptia ænea*)." It ascends the hills up to 4,000 feet, but is not found in the low country.

(27) CHLOROPSIS JERDONI.—Jerdon's Chloropsis.

Oates, No. 252; *Jerdon, No.* 463.

This is a very common bird in the low country and at the foot of the hills, but does not ascend them.

(28) IRENA PUELLA.—The Fairy Blue-bird.

Oates, No. 254; *Jerdon, No.* 469.

The Fairy Blue-bird, so aptly named, is very common, frequenting the largest forest trees in small parties from the foot of the hills to the summit. "Both sexes have a clear twittering note, which they utter from the top of some tree shortly before sunset and during the breeding season throughout the greater part of the day. Their food consists partly of insects and partly of berries."—*F. W. B.*

Mr. T. F. Bourdillon writes:—"It builds at elevations of from 500 feet to 3,000 feet above sea-level from January to May. The nest is totally unlike that of the Orioles, being extremely rude and flimsy, and has for lining a few dead leaves. It has very little depression in it, and is about 4 inches in breadth. I have had many eggs brought me and have myself taken several nests. One was in a small tree overhanging a stream at a height of 12 feet from the ground and was well concealed, another was in an exactly similar place rather higher up the same stream, a third was on a roadside in a thorny bush, and I would not have noticed it had I not seen the male bird fly away. This was also about 12 feet from the ground. The fourth nest was at a much higher elevation, but was otherwise similar to those I have mentioned. It only contained one slightly incubated egg however. The normal number of eggs is two, the ground colour is pale-green, but almost covered by the very fine spots of brown and walnut. These spots run into a zone at the larger end, which is present in every egg. The eggs themselves are pointed and glossy with a very fine shell. The average size is 1·0×0·78."

Sub-family *Brachypodinæ.*

(29) HYPSIPETES GANEESA.—The Southern Indian Black Bulbul.

Oates, No. 271 ; *Jerdon, No.* 445.

Numbers of this Bulbul may be seen and heard at about 3,000 feet elevation and upwards. I have only once met with them much below this, when I came across a very large flock at about 1,500 feet ; but Mr. F. W. Bourdillon says they are "found also, though in small numbers, at the foot of the hills." They are noisy birds, and in the South their notes are predominant at the elevation I have mentioned, as are those of *Trochalopterum meridionale* still higher. They occur throughout the range.

(30) MOLPASTES HÆMORRHOUS.—The Madras Red-vented Bulbul.

Oates, No. 271 ; *Jerdon, No.* 462.

This is eminently a bird of the plains, where it is very common, but I have never met with it in the hills. They breed from February to May. One nest I took in a thorny bush on the banks of a fresh water lake on March 29th contained two eggs. Another in a hedge of *Inga dulcis* in the Public Gardens, Trevandrum, at the end of April contained three young birds.

(31) OTOCOMPSA FUSCICAUDATA.—The Southern Red-whiskered Bulbul.

Oates, No. 289 ; *Jerdon,* No. 460.

This is the commonest of all the bulbuls and is found in the low country and throughout the hills, including the high range up to 6,000 feet. It frequents gardens in the low country and open jungle in the hills, and especially secondary forest.

Mr. T. F. Bourdillon writes:—"The eggs of this bird are very plentiful from December to June. It builds a very neat compact cup, not unlike a Chaffinch's nest externally, but lined with small roots resembling horse hair. This is usually placed in a bush, sometimes in the thatch of a building and not far from the ground, and contains three or four eggs, reddish-white, very plentifully spotted with purple, red and ashy. The spots generally run into a zone at the larger end, but by no means always. The average is 0·9 × 0·65."

(32) Iole icterica.—The Yellow-browed Bulbul.

Oates, No. 295; *Jerdon*, No. 450.

The Yellow-browed Bulbul is almost as common as the last, but is confined to the hills, where it frequents forest. I have seen it at all elevations from the foot to 2,000 feet in the south, above this in Pirmerd and the Cardamom Hills, and still higher in the High Range. It goes about in small flocks.

(33) Pycnonotus gularis.—The Ruby-throated Bulbul.

Oates, No. 303; *Jerdon*, No. 455.

This bird is not common. I have found it in open forest at the foot of the hills and also in thick forest at about 2,000 feet. On the ghât road to Pirmerd it may be met with more frequently than anywhere else.

(34) Pycnonotus luteolus.—The White-browed Bulbul.

Oates, No. 305; *Jerdon, No.* 452.

I have not met with the White-browed Bulbul myself, but my collector shot two in the low country near Cottayam in North Travancore in August, 1893. Since then I have had no more specimens.

(35) Micropus phæocephalus.—The Grey-headed Bulbul.

Oates, No. 313; *Jerdon, No.* 457.

This is a forest bird and I have only found it on the hills at about 2,000 feet elevation. Oates says it is "found from about Anjengo in Travancore." Anjengo is on the sea coast, and I doubt its being found there. If any specimen is so labelled it has probably been bought from an Anjengo collector. There used to be several of these men who made a living by shooting birds on the hills and bringing their skins for sale. They never labelled these and always said they came from Anjengo. I have shot this bird at only one place in the plains, and that is Kuttyani, which, as I have said already, is an exceptional locality where the old forest is still standing.

(*To be continued.*)

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NOTES ON THE ANOPHELES IN CEYLON AND ON THE LIFE HISTORY OF ANOPHELES FULIGINOSUS. GILES.

BY

MAJOR N. MANDERS, R.A.M.C., F.E.S.

(*With Remarks and Drawings—Plates A and B—by E. E. Green, F.E.S., Entomologist to the Government of Ceylon.*)

Many of these notes will be found identical with those of Dr. Sambon when studying the life history of *Anopheles maculipennis*, (Meign), British Medical Journal, January 26th, 1901, but it will probably be found necessary to study completely each species of the genus in our attempts to unravel many still obscure matters connected with mosquitoes and malaria; hence these notes taken at Trincomalie, extending from November 1900 to June 1901.

Anopheles, in my experience, can be more readily collected in the larval than in any other stage. The general appearance of the larva is now well known. If you find an insect (in appearance like fig. 1 of the plate) which, when alarmed, wriggles head first to the bottom of a glass, and after remaining there for a minute or two wriggles tail first to the surface; which on the surface progresses tail first in a skating manner and which finally rests with its tail against the side with its head pointing to the centre, you may be pretty certain you have obtained some member of the genus *Anopheles*.

I find that, in order to discover the larvæ of *Anopheles*, the following principles must be borne in mind:—

1. A certain amount of the food plant must be present.
2. The water must be tolerably clear; I have never found them in muddy water. This is directly contrary to some observers: see "The Campaign Against Ague," by Herbert Durham, F.R.C.S., British Medical Journal, March 2nd, 1901, who writes: "In fact, all the pools in which I have met "*Anopheles*' larvæ here (para. 1) have been muddy and "without manifest green growth."
3. If the food plant is so abundant as to form a thick scum over the entire surface of the water, *Anopheles* is absent.
4. It is absent as a rule in temporary collections of water such as puddles of rain water, unless the food plant is present, which is unlikely. *Culex* can be found anywhere, and is altogether a more robust creature than *Anopheles*.

A word as to the method I have found most successful for collecting the larvæ. Select a tank of any size, near a native village, which has floating on its surface a collection of water weed, but not sufficient to form a scum over the entire surface. Take a peg tumbler and skim the surface of the water, preferably in clear water near the margin between the masses of weed; do not skim too rapidly, or the contents of the tumbler will be washed out as rapidly as they are taken in, or too slowly, otherwise the larvæ will have time to dive to the bottom; but with a happy medium begotten of experience. A strange collection of the denizens of the pond will be found in the tumbler, but after allowing the contents to settle, the *Anopheles* larvæ will come to the surface and can then be transferred to another vessel—a French plum jar does admirably. Where the larvæ are abundant, a hundred specimens or more can be collected in an hour. It is quite immaterial whether the tank is full of frogs or not: one can frequently obtain a haul of larvæ in their immediate proximity. It would be wearisome to recount my manifold difficulties in bringing my larvæ to maturity, and it is to enable others to avoid my numerous pitfalls that I write these notes.

The larvæ require constant sunshine, plenty of water weed and a vessel with a broad surface. I lost numbers by keeping them in a French plum jar in the shade; now I expose them to the full sunlight all day. A glass finger bowl does admirably, and being placed in the sunlight causes the food plant to grow. It is not necessary to cover the bowls with muslin, but they should be examined most carefully every evening, and any larvæ turned to pupæ should be at once transferred to glass test tubes with a teaspoonful or so of water and carefully stoppered with cotton wool. It is important that all bowls and test tubes should be labelled with the place and date of capture.

By varying the amount of sunlight and the temperature of the water the growth of the larvæ can be materially hastened or delayed. It is advisable to remove from the bowls any other water creatures, such as the larvæ of dragon flies, water beetles, "water boatmen," etc., which no doubt feed extensively on *Anopheles*.

The staple food of the larvæ is no doubt the green algæ floating on the water, but it is not by any means their only food. I have seen them eating pieces of *Nais graminea* and have kept and reared larvæ on a minimum of vegetable diet, their chief sustenance being derived from the decaying bodies of insects such as butterflies, cockroaches, etc., put in the water; the cast skins of the larvæ and pupæ are also occasionally nibbled at. I have not actually caught them in the act of cannibalism, though I have seen it stated that some species are addicted to the habit of devouring their weaker brethren.

The larvæ as a rule lie horizontally on the surface of the water, usually on the outskirt of any patch of water weed at the margin of which they feed. They appear to be very ravenous creatures, the whorl organs which bring food to the larvæ by the current set up by their rapid motion being almost incessant throughout the day, though, as far as I am aware, they cease feeding at night.

Perhaps the most remarkable thing concerning the habits of the larva is its method of feeding. The head is attached to the thorax by what might almost be termed an universal joint; it is capable of being turned round in almost a complete circle. Its usual method of feeding has been well described by Dr. Sambon (loc. cit.) and Mr. Austen (Practitioner, Vol. LXVI., No. 3). Lying flat on the surface of the water, by a sudden and extremely quick movement it revolves its head until the mouth becomes uppermost, the whorl organs are then rapidly expanded and retracted, or rather perhaps by a to and fro movement a considerable current is produced by which the particles of food are brought to the mouth; after some time the whorl organs cease their movement and the head is as rapidly turned round again. The larva also fixes itself by its caudal bristles and feeds below the surface amongst the weed in a more natural manner; it is in this position that the delicate hairs which are set between the antennæ are best observed. The function of these hairs, it has been suggested, is to support the head when it is feeding mouth upwards. In captivity the majority usually lie parallel with each other round the margin of the bowl with their heads all pointing to the centre.

I am unable to say, in spite of close observation, how many times ecdysis takes place in the larval stage, but I think not more than five or six. It invariably takes place during the hottest time of the day, usually between 12 p.m. and 3 p.m. A slit appears on the dorsal surface of the skin out of which the larva wriggles tail first. The head, thorax and tail are then colourless, the various parts of the head being indistinguishable and remaining so for some time. The change takes about five hours to complete from the time of the rupture of the skin to the return of the head parts to the normal; the larva afterwards proceeds to eat vigorously.

The larva dies rapidly if removed from the water and placed on a dry surface, but will survive for several hours, possibly days, in a single drop of water. I have seen it advocated that the destruction of *Anopheles* can be extensively effected by dragging the tanks by means of small skeined nets, and no doubt enormous numbers of the larvæ could be destroyed by systematically dragging the tanks and freeing them from water weed ; but, if such a course be pursued, care should be taken that the net be not again used until perfectly dry, as the larvæ will easily survive in the film of water clinging to the meshes of the net, and will be simply replaced in the water.

The larvæ of *Anopheles fuliginosus* are killed in less than twenty-four hours in a fifty per cent. solution of sea water and in a twenty-five per cent. solution in a little longer time ; in a five per cent. solution they will live for several days. The salt water acts as a direct irritant to the breathing tubes, as the insects constantly try to clean them by passing them through their mouths.

[It is probable that, under natural conditions, some species of *Anopheles* are able to bread in sheltered bays and inlets of the sea. I found *A. rossii* swarming in the bungalows at Batticaloa where fresh water exists only in the deep wells used for the supply of drinking water. There is no fresh surface water anywhere in the neighbourhood. Some other *Culicidæ* can make themselves at home in water having a salinity of over 1 per cent. I particularly noticed an instance in which *Armigeres ventralis* Walk., bred freely in a vessel of dilute sea-water containing 1·05 per cent. of salt. The vessel was exposed in the verandah of my laboratory and was utilized by the mosquitoes, although they had free choice of fresh wáter in the immediate vicinity.—E. E. G.]

In the case of a *Culex* larva placed in a saucer full of water, with five drops of kerosine oil added, death took place in a quarter of an hour ; the long straight breathing tube was evidently in difficulties ; towards the end the larva swam about with its mouth out of water like a fish in non-aërated water. Kerosine oil induces death from suffocation; carbolic acid and izal apparently act as caustics. The larvæ of *Culex* were killed at once in carbolic lotion 1 in 40, but the pupæ lived over an hour; izal destroyed both larvæ and pupæ immediately. The chitinous envelope of the pupæ protected it seemingly from the action of the carbolic acid for some considerable time. This strength carbolic acid is evidently a very feeble insecticide.

It is difficult to ascertain the exact length of time required for the development of the insect from the egg to the imago, as hitherto I have not discovered the egg of *Anopheles fuliginosus.* I have frequently found the larvæ when they have measured only 1 mm. in length, and presuming that the temperature is pretty uniform as it is at Trincomalie at this time of the year (March-May), namely 93° in the shade and 80° at night, the time required would be not less than three weeks under favourable circumstances. A rapid succession of broods is constantly taking place during the active life of the imago, from January to June at any rate, as is evidenced by the different growths of the larvæ when collected.

The pupa of *Anopheles fuliginosus* can, I think, be scarcely distinguished from others of the genus ; it is extremely active when disturbed, progressing by a rapid to and fro movement of its two caudal fins ; as a rule it remains quiescent on the top of the water with the air tubes just awash. On being disturbed it seeks refuge by diving to the bottom tail first and hiding in the interstices of the water weed, but it is unable to remain under water for any length of time and ascends again by its own buoyancy.

It remains in the pupa stage almost exactly twenty-four hours ; the final change from the larva to the pupa takes place towards sunset, and twenty-four hours afterwards the imago is produced. Invariably, the imago is hatched out between the hours of 7 p.m. and midnight, usually between 7 p.m. and 8 p.m., and takes place thus :—

The back of the thorax at its apex becomes slightly tilted up for some few minutes, the tail parts—which as a rule lie curled forwards beneath the head—become extended, and this is the first obvious sign that the final stage is about to take place. One or two violent contractions and extensions of the tail cause the thorax to split down the centre ; there is then a momentary pause, after which the contents of the thorax and abdomen shoot forward, causing the insect to rise suddenly from its case and remain at a somewhat acute angle with the pupal covering; the fore and middle legs being now extended, release the head and palpi which were tucked up underneath the thorax. Immediately the head is released, the insect shakes itself free from the pupa case and crawls on to the surface of the water, if no other support be near ; the wings are developed almost instantaneously, but are somewhat limp and unavailable for flight until five minutes have elapsed ; the legs are, however, stronger, and it is on them that the insect depends in the first instance. If the wings get wet, the insect is done for, as it thus lies helpless on the water. The above performance takes rather less than a minute for its completion. The ability of the insect to rest on the surface of the water without injury is noteworthy. In colour the pupa is pale brown, becoming darker brown as the insect reaches maturity. Frequently the pupa is in the first instance pale green and this is more frequently the case if the change takes place amongst the food plant. The eyes can always be distinguished as two black spots.

The resting position assumed by the perfect insect is similar to that of other species of the genus and at once distinguishes it from *Culex*. Personally I fail to see how they can for a moment be confounded once the characteristics of the insects are recognised. *Anopheles fuliginosus* is altogether a more delicate-looking creature; the wings are kept closely pressed against the body, and the head being very small and in the same straight line with the body (and also the palpi) the insect when at rest looks like a thin thorn stuck sideways into a bit of wood. The posterior legs are frequently elevated above the body, more especially when resting on a perpendicular surface, and it has a curious habit of waving them about with a rotatory motion for some time at short intervals. They frequently do this when feeding on banana or imbibing blood ; whether the snow-white tarsi are of any particular benefit to the insect during these manœuvres I am unable to say, possibly they act as "warning" organs. The humped back and robust thorax of *Culex* is to my mind quite distinctive.

[This habit of elevating and waving the posterior pair of limbs is not peculiar to this species or genus. I have observed it in many species of *Culex* and allied genera when feeding, or when coming to rest after a flight—E. E. G.]

This species of *Anopheles* will live two or three days without food, but they readily suck the juice of a ripe banana, and the females suck blood without much persuasion. The males do not suck, this disagreeable practice being confined to the female. Their greed is remarkable: they fill themselves to such an extent that the blood exudes from the anus, and even then after a surfeit of blood they will make a dessert off banana. I know of few insects so quick in their movements as *Anopheles fuliginosus*, and one has to be extremely careful lest any escape from confinement. They make for any hole in the muslin in a moment and get through with remarkable nimbleness. They will, however, almost invariably fly to the top of any vessel containing them ; if kept in a test tube they settle on the cotton wool, and if the test tube is inverted they will then make their way to the bottom end.

In the tropics one has to remember that the banana is not only attractive to *Anopheles* but to other things as well, and the cage should therefore be kept with its legs in water. I have found before now a

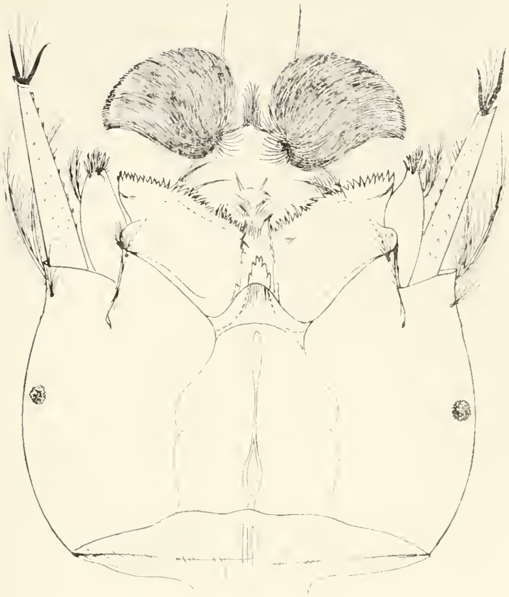

FIG. 2

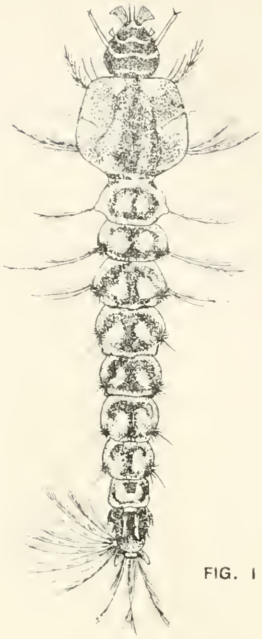

FIG. 1

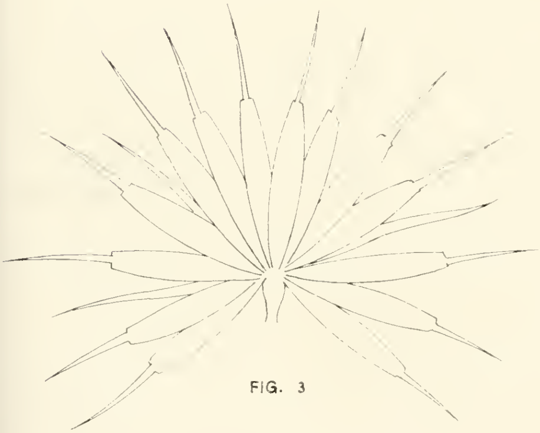

FIG. 3

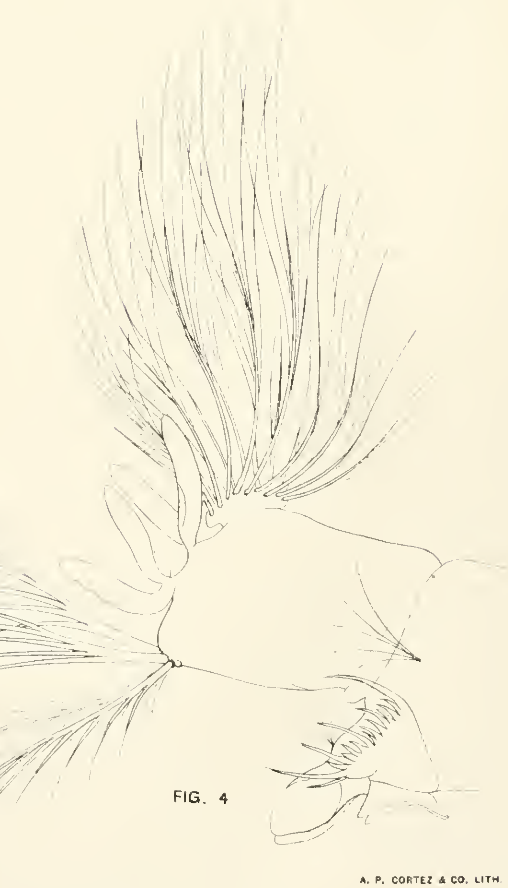

FIG. 4

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swarm of minute ants in the cage, which they had entered by cutting a small hole in the muslin and through which *Anopheles* was on the point of making its way. On a still more sad occasion I found that a misguided rat had eaten, in the night, a hole through the cover, with the result that about a dozen *Anopheles* which had had a satisfactory meal from my arm in the evening had escaped; as there were some fever cases in the hospital close by, I experienced the feelings of a man who has inadvertently let loose a live torpedo in a crowded harbour. The cage therefore must be protected from every possible assailant.

Anopheles fuliginosus has the same musical note as the ordinary *Culex*, at least my unmusical ear can detect no difference. Not only is it an exceedingly nimble, but it is also a fearless creature. I have repeatedly examined them, when feeding, with a lens of $\frac{2}{3}''$ focus without any symptoms of apprehension on their part.

Description of full-grown larva (fig. 1) under lens $\frac{2}{3}''$ focus.—Length 5 mm. comprises a head, thorax and nine segments. The head (fig. 2) bears the eyes, antennæ, mouth and whorl organs. It is usually pale brown mottled with darker brown, particularly about the mouth parts; globular slightly produced anteriorly. The eyes, two in number, are placed at the base of the antennæ--black. Antennæ two-thirds the length of the head project forwards and outwards to a level with or beyond the whorl organs, usually pale brown in colour, minutely forked at apex—black. The whorl organs are situated on the anterior portion of the head close to the mouth and consists of two bundles of extremely fine hairs convex outwards; internal and parallel with them is a single long straight seta on either side passing directly forwards.

The thorax is larger than the head or abdominal segments, somewhat quadrate, broader from side to side than from before backwards, broader posteriorly than anteriorly; translucent, varying in colour, but usually pale olive green externally, darker olive green in the central line, with two white or whitish circular markings anteriorly on either side of the dorsal line. It bears several fine setæ, sometimes almost in tufts, more particularly on the anterior border and posterior angle, the latter being much the longer—all projecting forwards; a few also are on either side of the central line.

Segments usually green with darker central line, the penultimate segment greenish red. The first three have from their posterior angle fine bundles of branching setæ which branch boldly forwards. The next four are likewise provided, but the setæ are exceedingly delicate and are either at right angles with their segments or pass backwards parallel with the body. They have their origin at the posterior angle of the segment. Besides the above, on the 5th to 10th segments, at their posterior angles, are arranged radiate tufts of hairs difficult to discriminate under such a low power and which probably serve as floats (fig. 3) to support the body on the surface of the water.

[These floats have a different structure to the other bundles of hairs. Each float consists of a peduncle bearing a radiate series of acuminate flattened scales (see Fig. 3).—E. E. G.]

The breathing tubes, two in number and reddish in colour, lie parallel with each other and pass backwards over the last segment but not beyond its anterior third; they arise from the eighth segment from somewhat enlarged dark green bases.

The ninth segment (fig. 4) is pointed posteriorly and carries three bundles of hair, the central one directed backwards and half the length of the external ones which pass outwards and backwards. Beneath them is a somewhat thick bundle of hair by which the insect is enabled to attach itself.

The larvæ under a lens of $\frac{2}{3}''$ focus may be thus distinguished at various stages of growth.

Larva 1 mm. Head light red, mottled with darker red, sometimes dark brown, base of head dark red. Antennæ brown eyes not distinguishable; thorax smaller than head, anterior third white, posterior two-thirds olive green and body olive green.

Larva 2 mm. Head reddish mottled with darker brown, thorax not broader than the head, anterior portion white, usually forming a white collar at the junction of the head with the thorax, remainder of thorax dark olive green, body the same with darker central line, penultimate segment paler, breathing tubes brown; the branching setæ on the various segments quite distinguishable.

Larva 3-4 mm. Head dark reddish brown mottled with lighter brown, thorax broader than head; collar less conspicuous, particularly so in middle line, but very variable; very frequently the collar is replaced by two conspicuous white dots on either side of the middle line, occasionally with a brick red spot between them. In other specimens the spots are translucent green, almost the same colour as the rest of the thorax.

Larvæ kept in a vessel of clear water with a sheet of white paper beneath, are altogether paler in colour than above and may even be

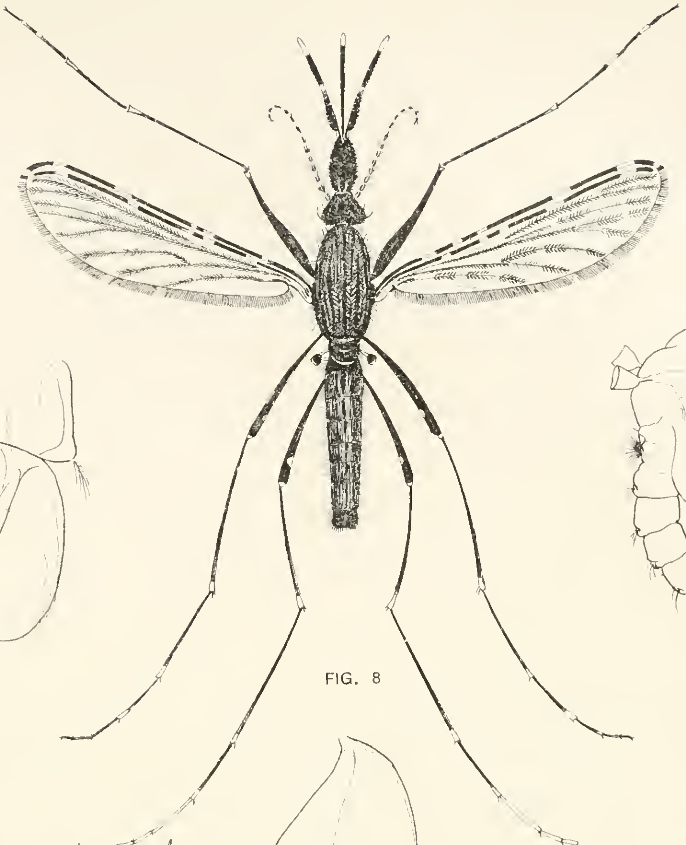

FIG. 8

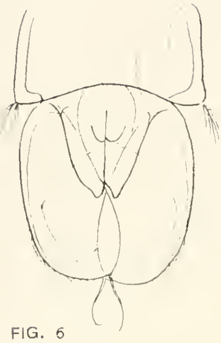

FIG. 6

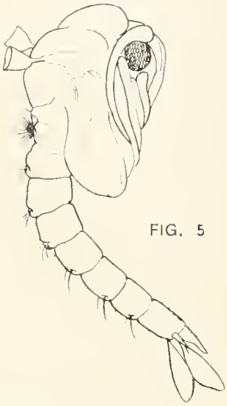

FIG. 5

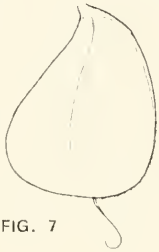

FIG. 7

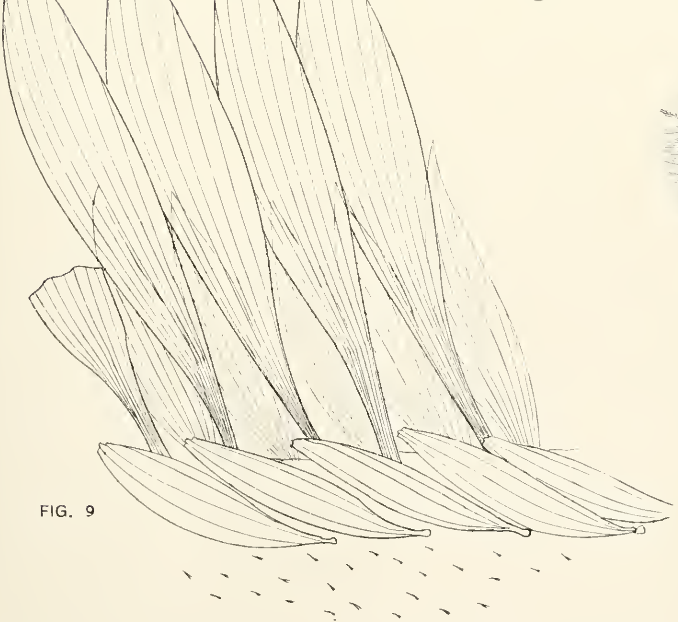

FIG. 9

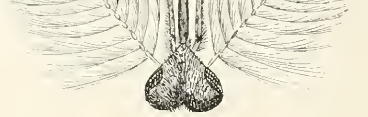

FIG. 10

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altogether reddish brown, light greyish brown, or with numerous small white spots scattered down the dark central line.

Pupa (fig. 5), length 5 mm., pale green or light brown changing to dark brown before emergence. The head and thorax are confined in one common chitinous semi-transparent envelope through which the various organs, especially the eyes, can be made out. On the dorsal surface is a pair of beautiful white funnel or trumpet-shaped breathing organs. The tail parts are bent round under the head and bear on the last segment a pair of white spatula-shaped "fins" (figs. 6, 7).

[The pupa bears a single pair of floats on the dorsal surface of what appears to be the first abdominal segment. Each caudal fin carries a short curling seta at its extremity (fig. 7).—E. E. G.]

Imago (fig. 8), expanse 5-6 mm. Male and female; head black covered with greenish grey hairs with longer whitish hairs on the vertex; eyes black.

Antennæ black minutely ringed with white; that of the male (fig. 10) plumose; of the female ciliated.

Palpi of male greyish brown variegated with white, the plumose tips delicately white; of female 1st and 2nd joints brown, the 5th white, the 3rd and 4th brown ringed with white at the joints.

Proboscis brown ringed with white just before the tip.

Thorax dark greenish grey with two obscure longitudinal black lines on either side of the middle lines; beneath black mottled with bluish grey.

[Dorsal area of thorax with longitudinal series of pale scales.—E. E. G.]

Abdomen dark greenish grey.

Legs, coxæ brown. Prothoracic legs. Femur and tibia pale brown. Tarsus brown; joints ringed with white. Ungues brown. Mesothoracic legs. Femur, upper $\frac{2}{3}$ golden brown, lighter on the inner side, lower $\frac{1}{3}$ black with a rounded white spot above the joint, which is also white. Tibia similar to above, but with no rounded white spot. Tarsus almost entirely brown, joints obscurely ringed with white. Ungues brown.

Metathoracic legs similar to the mesothoracic; the first joint of the tarsus is brown, the remainder snow white.

Wings of both sexes blackish, fuscous or dark fulvous, due to alternate patches of lighter and darker scales on the veins.

The costa, mediastinal and first longitudinal veins black. Costa with five white spots. The first small confined to the costal margin and close to the base of the wing. The other spots extend on to the first longitudinal vein. The second nearer the first than the third, which is usually nearer to the fourth than to the second. Five close to four at the apex. The second and third the same size; the fourth rather larger. Cilia alternately black and fulvous, the latter where the veins join the margin of the wing.

[There is a considerable range of variation—not in the actual pattern of the wing-markings, but in the intensity and extent of the dark scaled areas, and consequently in the size of the pale spaces. In some examples, the membrane of the wing is itself tinged with fuscus. The membrane is also uinformly specked with minute black bristles. The cilia (fig. 9) consists of a double row of elongate lanceolate scales, those of the lower row only half the length of the upper scales.—E. E. G.]

The relationship between *Anopheles fuliginosus* and malarial fever, if any, is obscure. Trincomalie for the last hundred years, indeed since the British occupation in 1795, has had a most unenviable reputation on account of its unhealthiness. In 1898 the mortality amongst the native population was 56 per 1,000, the highest in the Island, and due almost entirely to malarial diseases. The fever amongst the garrison has until the last three years been very severe. Fort Frederick, where the majority of the troops have until lately been quartered, is built upon or rather occupies the whole of a peninsula projecting into the Bay of Bengal composed of gneiss with outcrops of quartz much disintegrated on the surface. It is connected with the mainland by a causeway and moat (of which more anon). The unoccupied portion of the Fort is covered with light jungle. It is separated from the native town by an open common about a mile and a quarter in circumference which is military land used as a parade ground. At the beginning of the British occupation this was a dense mangrove swamp, but was drained about the year 1800 by Colonel Champaine. The town is very low lying, the surface water being only a few feet below the level of the soil. There are numerous cocoanut plantations in and around the town, and during the North-East Monsoon the water is banked up to water the young growing trees. There are also on the outskirts several tanks surrounded by Hindoo temples and other buildings, which mostly consist of mud huts or shelters composed of palm leaves and thatch. The town contains 11,000 inhabitants. The tanks are used for washing and frequently for drinking purposes, but are not so foul as those usually seen in India. Immediately beyond the town, and extending inland in all directions for some hundreds of square miles, is a dense forest and almost impenetrable jungle highly malarious for a great portion of the year and maintaining a scanty population of feverstricken people who eke out a miserable existence in a few scattered villages.

The opinion of the natives as to the causes of malarial fever is interesting, founded as it has undoubtedly been from direct observations for many years and probably the accumulated experience of centuries, and it is interesting also to note that various medical officers serving with the troops in Trincomalie have from their own observations formed similar opinions to those held by the many intelligent natives of the district. So long ago as 1798 Assistant Surgeon Colin Rogers, of the 80th Regiment, gave in his medical report a very complete account of the reasons which induced him to think that the cause of the malarial outbursts were due to the South-West Monsoon blowing into the Fort after traversing many miles of noxious jungle. He says :—

> "During a residence of 4 years at Trincomalie I have always observed "that the season has been most healthy when the rains fall early in November "or December and the setting in of the South-West Monsoon is late. In "this case the North-East Monsoon or sea wind, continuing to blow for "several months after the falling of the rain, the country is rendered in a "great degree dry and the unhealthy vapours are dispersed before the wind "shifts to the south-west and blows over the land which in the neighbourhood of Trincomalie is in many parts marshy and almost entirely "covered with jungle. The rains at Trincomalie commenced in November "last and ceased early in January, since which time there has been dry "weather with a regular sea breeze which continued to prevail until the "end of April, by means of which the unwholesome vapours are blown from "the Fort and the stagnant water will be nearly dried up before the monsoon changes.
>
> "In the year 1797, on the contrary, during which the troops suffered much "from remittent fever and berry-berry, the rains fell late in the season and "the monsoon changed early in April, so that there was much moisture in "the jungle and stagnant water on the ground when the south-west wind "set in, and blowing over the land carried the unwholesome vapours towards "the Fort and produced diseases similar in their nature and almost equal in "their malignity to those lately contracted in the Candyan territory."

It was in 1898, exactly one hundred years after the above was written, that the medical officer in the same station attributed an outburst of fever in Fort Frederick to precisely similar causes as his predecessor had done a century previously. He writes :—

> "I attribute the great decrease in fevers to the fact that the past year "has been a very dry one ; very little rain fell after December 1897, so all "the country was thoroughly dry before and during the hot weather (March, "April, and May). The usual bad months proved healthy. There was a "sudden large increase in fevers during June. It set in with the com-

> "mencement of the South-West Monsoon, which is a very dry land wind, and "chills are very easily caught if men sit about in wet clothes. This year the "majority of the cases came from Fort Frederick and not from Ostenbury "as in the previous year. There is a moat to the south-west of the Fort, "which had a lot of stagnant water left from the previous rains. This was "drying up very rapidly and gave off a very offensive smell, and I think that "much of the fever was probably due to this little marsh, as at change of the "monsoon the marsh air was swept over the Fort and it was the people in the "low ground that suffered mostly. This moat has since been filled up."

It was about the year 1898 that the mosquito-malarial theory was becoming more widely known, and it is likely enough that this will be the last medical report in which malarial fever is attributed to offensive smells. However that may be, many points yet remain obscure. With regard to the moat, no doubt this was a fine breeding place for *Anopheles*, which found their way readily into the barrack rooms almost overlooking it, and now that it has been filled up, *Anopheles* and fevers have to a large extent disappeared, a great good being effected, though through mistaken reasoning.

It has been suggested to me that the south-west wind blows *Anopheles* with its lethal poison into the Fort: this I am quite sure is not the case. It is contrary to the habits of all mosquitoes to allow themselves to be blown about by the wind. The stronger the wind the more they seek the shelter of bushes and so forth, and they seldom show themselves during the prevalence of a strong wind.

There are one or two questions very interesting in themselves which await solution by future observers here;—for instance, does *Anopheles fuliginosus* convey malarial fever? My own impression, given with the greatest deference, is that it does not; otherwise I cannot account for the present state of affairs. For the last five months (January—May) *Anopheles fuliginosus* has been breeding in swarms in the tanks in the town; but malarial fever, except for a few cases (sufficient to be a means of spreading the malarial poison), is remarkable for its absence. During this last fortnight (May 1st to 14th), when the little monsoon broke, the fever began to show itself. This in other ways is not a healthy wind; when it first starts, coughs, colds, and general malaise are very common, but pass off when the wind is thoroughly established.

[In a recently published paper on "Malaria in India" by Capt. S. P. James (Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, New Series, No. 2, p. 39) the author writes of *A. fuliginosus*: "Experimentally we have shown that the parasites of quartian, tertian and malignant tertian malaria will develop in this mosquito. We have not, however, found it infected under natural conditions."—E. E. G.]

Possibly the poison is conveyed by the other species of *Anopheles.* I have found here another species which at the present moment is very rare, at least so far I have only taken two specimens.

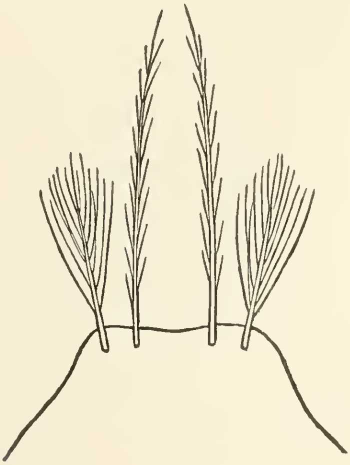
[I have been unable to determine this species to my satisfaction. It is very near *A. rossii*, but has a more silvery thorax. Of *A. rossii*, also, Capt. James writes: "Experimentally we have proved that the three species of the human malaria parasites will develop in this mosquito, but we have never yet found it infected in nature."—E. E. G.]

It is possible that for some obscure reason it is now approaching extinction; possibly it will become active at the onset of the South-West Monsoon. It may puzzle some of my readers that this should be a dry wind, but the explanation is that it loses its moisture when passing over the hill country in the south-west of the Island.

Note.—June 20th. So far there has been an almost entire absence of fever this year, *Anopheles* still breeding in the tanks.

[Recent study of the larvæ of mosquitoes of the genus *Anopheles* has shown that good specific characters may be found in the form of the 4 frontal hairs always present on the anterior margin of the head. They are usually more or less obscured by the extended whorl organs, and can be best observed when those organs are retracted or removed. In some species, the 4 hairs are simple and unbranched: in others, the inner hairs may be simple and the outer pair branched: in yet others both pairs may be plumose, in varying degrees.

In the present species, the median hairs are slightly, and the outer hairs densely plumose (see fig. below):—



Frontal hairs of larva of *Anopheles fuliginosus.*

In Vol. III of his "Monograph of the Culicidæ," Mr. Theobald has sub-divided the genus *Anopheles*, and now places *fuliginosus* in the genus *Nyssorhynchus* of Blanchard.—E.E.G.]

EXPLANATION OF PLATES.

Plate A.

Fig. 1, Larva, dorsal view : × 20.
,, 2, Head of larva, ventral aspect : × 100.
,, 3, Dorsal float of larva : × 400.
,, 4, Posterior extremity of larva, from the side : × 80.
(The exigencies of the plate have necessitated the inversion of this figure. The dorsal margin is below).

Plate B.

Fig. 5, Pupa, side view : × 15.
,, 6, Posterior extremity of pupa, ventral aspect : × 40.
,, 7, One of the caudal fins : × 40.
,, 8, Adult female, dorsal aspect : × 15.
,, 9 Part of fringe, from inner margin of wing : × 850.
,, 10, Head of adult male, dorsal aspect : × 20.

THE TREES AND SHRUBS OF THE LONAVLA AND KARLA GROVES.

By

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College of Science, Poona.

The groves botanically examined were five in number: the first, also the largest and most popularly known, in Lonavla at the head of the Bhor Ghat, consisting of a broad belt of large trees and with many enormous climbers; the second, a small wood to the north, near the Tower of Silence with fine specimens of *Anodendron* and *Gnetum*; the third, a small wood to the south of no special interest; the fourth, a larger wood on a small, conical hill, near the railway line about half way between Lonavla to Karla, in which the trees are literally festooned with large climbers; and the fifth, the wood at Karla village lying between the railway station and the cave temple, in many respects the most interesting of all. The majority of the trees and shrubs are either in flower or fruit during the hot weather, when the smaller plants are absent, so that the botany of the scattered areas under consideration, being of limited scope and yet well diversified, would offer a favourable opportunity to any one wishing to lay the foundations of a practical knowledge of Systematic Botany. It must be understood that the country immediately surrounding these woods is very bare in the dry season. The woods at Lonavla itself are well separated and the fourth and fifth lie far apart. Southwards the ridge of the Sakar Pathar range is seen covered with low jungle.

The woods are supposed to be sacred groves in which are preserved the remnants of forests which once covered the Deccan. There can be but slight grounds for this supposition, because the greater proportion of the trees and shrubs enumerated here belong strictly to the Konkan Flora and they exist under Konkan conditions now, as even the Karla wood, which lies farthest from the Ghat, is well within the heavy rainfall zone where the extreme temperatures of the Deccan do not prevail. The groves at Lonavla are scattered over a wide extent of laterite, and there is no reason why the whole station should not be covered with equally good trees, but the fourth and fifth woods are on isolated mounds of sandy laterite, rising out of a darker soil, and it is interesting to observe how their growth diminishes and at length ceases as their margins merge into this darker soil. Their existence is probably as much a matter of soil as of climate. No forest patches of the same character are again met with in journeying towards Poona. If the Deccan were ever covered with such forests its climate and soil must have been vastly different in former times.

The locally accepted vernacular names are added to most of the botanical to assist any enquirer who may work over the same ground. Most of the details were taken down on the spot in my field note books. I have also pointed out a few of the facts which struck me as being very interesting when they came under my own observation, but these woods teem with absorbing lessons to a field botanist and they furnish an endless series of botanical problems.

RANUNCULACEÆ.

Clematis hedysarifolia, *D.C.* *Bendri chi vel.*

In all the woods. It is really the commonest small climber in Karla wood ; but all the plants are browsed down to a height of six inches or so. At its best it is never more than a harsh meagre plant. Its brownish flowers are neither conspicuous nor abundant. Its congener *Clematis triloba* (Mor vel) beautifies the rugged Deccan Hills in the autumn and its flowers have the delightful scent of May.

CAPPARIDEÆ.

Capparis Moonii, *Wight.* *Wagati.*

A spindly climber in dense thickets, but densely covering isolated bushes in the open. The large white flowers are very handsome, but they fall in pieces very rapidly.

Cratæva religiosa, *Forst. f.* *Waiwarang.*

One small tree planted in Karla village, 12 feet high, stem clear for 6 feet, girth 1 foot. Petals white, turning yellow, distinctly clawed. This small tree is usually found near temples.

MALVACEÆ.

Thespesia populnea, *Soland.* *Bhendi.*

Cultivated in Karla village and not an actual denizen of the wood. Flower large, yellow, with a dark purple eye.

Thespesia Lampas, *Dalz and Gibs.* *Ran Bhendi* (a vernacular name applied indiscriminately to many shrubby members of this order). A lanky shrub bearing fine yellow flowers with dark red centres.

Bombax malabaricum, *D.C.* *Saier.*

Largest plant in our area measured 60 feet in height, stem clear for 25 feet, girth 11 feet. Fruit 4½ inches by 1¾ inches, valves woody, brittle, placentas and inner part of dissepiments yellowish brown ; large stellate tufts of cotton often one inch long. These tufts of hairs spring from the valves. The silk cotton tree in flower is the glory of the country along the railway line from Khandala to Talegaon at the beginning of the hot weather. As a rule it never attains a great size. When the separate whorls of branches are at sufficiently distant intervals, it is interesting to observe that each section of stem does not taper so that the trunk is formed on the plan of an inverted telescope. The flowers vary much in form and colour, the most common being of a vivid red with broad petals, the rarer almost salmon with long, strap-shaped petals. The cotton is usually glistening white and I have once seen it of a pale buff colour.

Its congener *B. insigne*, Wall., which is so common in the forests below ghats only ascends them as far as the Reversing Station. Some individuals of this species are densely armed to the base, others are quite unarmed; thus, as in the case of many so-called armed trees this character is safely negligible. The tubercles bearing the prickles are corky and distinctly lamellate, so that the layers can be separated by the pressure of the thumb. The prickles are single or arranged in ranked clusters. The leaves are often very hairy beneath even when old. The flowers are not arranged in groups as in *B. Malabaricum*, but singly along the branches, their petals are usually long and strap-shaped, varying in colour from light orange to dark red: the stamens form a dense tassel of innumerable, long, white thread-like filaments. In many respects this is the noblest flower to be found in the Presidency.

The fruit is almost double the length of that of *B. Malabaricum* and it is distinctly angular. (The dehiscence in both is septifragal and not loculicidal as given in Floras.) The axis and dissepiments of the fruit often remain on the branches and revolve in the wind like children's toy paper mills. (This is a rare occurrence in *B. Malabaricum*, but I have observed it.) The cotton appears to be always of a drab colour and a pod often contains a large quantity.

After the fruits ripen and fall away the silk cottons put forth their leaves. The fallen flowers carpet the ground for months, becoming almost black, and are reduced by shrinkage to less than a third of their original size.

STERCULIACEÆ.

Sterculia guttata, *Roxb.* *Kukar.*

A densely leafy tree. The fruits, which are in clusters of woody follicles, are very interesting when they open out, showing a yellow inner surface and large seeds attached to the margins.

Sterculia colorata, *Roxb.* *Kavshi.*

Does not actually grow within any of the woods, but is found on their outskirts. The trees are leafless when covered with their peculiar reddish-brown woolly flowers whose colour is not sufficiently decisive to render the tree at all conspicuous from a distance. The follicles are flat, papery and veined like leaves when ripe, with a yellow seed adhering to each margin.

TILIACEÆ.

Grewia tiliæfolia, *Vahl.* *Dhaman.*

A small shrub or moderately sized tree. Flowers bright yellow in umbellate clusters.

MALPIGHIACEÆ.

Hiptage Madablota, *Gærtn.* *Halad vel.*

A large, much branched and leafy climber, at first very striking with its profusion of scented white flowers (odd petal blotched with yellow) and afterwards with the abundance of hard brown winged fruits.

Aspidopterys cordata, *A Juss.* *Bar vel.*

A climber on the small trees on the outskirts of the woods. Leaves large, white, woolly beneath; flowers small, yellow, in large, loose drooping panicles. Fruits brown, papery, circular, very conspicuous, as they are produced in such great numbers.

RUTACEÆ.

Zanthoxylum Rhetsa, *D.C.*

A small, deciduous tree, seen only in Lonavla grove, armed as is *Pangara.* It flowers during the rains.

Glycosmis pentaphylla, *Correa.* *Mendki.*

A weedy shrub of little interest.

Atalantia racemosa, *W. & A.* *Makad limbu.*

A large, spiny, orange-like shrub. Fruits round, like small limes.

BURSERACEÆ.

Garuga pinnata, *Roxb.* *Kakad.*

One tree in Karla village, 20 feet high, stem clear for 6 feet, girth 18 inches. The flowers and fruits of this tree are usually over before the foliage is perfectly developed.

MELIACEÆ.

Dysoxylum binectariferum, *Hook. F.* *Yerindi.*

In Lonavla wood. A deciduous tree, 25 feet high, stem clear for 4 feet, girth 5 feet, bark grey, exfoliating in small flakes. Fruits large as an apple, when ripe gaping to show their yellow lining.

CELASTRINEÆ.

Celastrus paniculata, *Willd.* *Kangani.*

A very common climber ; bark smooth, with gray spots, foliage shining ; flowers in loose, drooping panicles, small, white ; fruits copious, bright yellow.

Gymnosporia emarginata, *Grah.* *Yenkli.*

A coarse, strong, spinose shrub. Leaves leathery. Flowers small, in clusters from tubercles on the branches ; fruits bright red, white on the inner sides of the valves, seeds yellowish.

RHAMNEÆ.

Ventilago madraspatana, *Gærtn.* *Kan vel.*

A climber, reaching the tops of the tallest trees, stem attaining 3 feet in girth. Fruit pea-shaped at base expanding upwards into an oblong, membranous wing. This is common in all the woods. In Lonavla wood, the lower parts of the stems, dragged down by their own weight lie along the ground or form fantastic loops and knots.

Zizyphus rugosa, *Lamk.* *Toran.*

A large, straggling, armed shrub, climbing when opportunity occurs. Fruit light yellow, sloe-like in taste, but rather too dry to be palatable.

SAPINDACEÆ.

Allophylus Cobbe, *Blume.* *Tivat.*

At Karla wood there is a small tree of this, 12 feet high, stem clear for 8 feet, girth 10 inches. Standing in the open as this plant does, it must grow erect, but in thickets, where it is most usually found, it prefers to exist as a climber.

Schleichera trijuga, *Willd.* *Kosim.*

Only small plants of this seen in the woods.

ANACARDIACEÆ.

Mangifera indica, *Linn.* *Amba* ; *Mango.*

The largest specimens are at Karla, height 50 feet, stem clear for 12 feet, girth 10 to 13 feet. The villagers rick their straw on the branches exactly as I have seen in Kashmir and Chumba. The fruit produced is said to be very indifferent and the people endanger their health by eating it very unripe. One variety bears small fruits in bunches of 10 and 12, but no one could give me its vernacular name. Trees standing in the open are terribly infested with *Loranthi*, and boring insects readily enter lopped surfaces and wounds, so that most of the large trees are hollow. The position occupied by dead and gone parasites are indicated by large swellings on the branches.

Semecarpus Anacardium, *Linn. f. Bibha*; *Marking Nut.* Two or three small plants seen at Karla. The variety *cuneifolia* must have quite disappeared from Lonavla Grove.

Holigarna Grahamii, *Hook f.* ? *Bibha.*

A common and the most striking tree at Lonavla wood. Largest specimens measured 50 feet in height, stem clear for 10 feet, girth 3 to 6 feet. The leaf stalks have 1 to 3 pairs of peculiar, erect spur-like processes, ½ inch long. The main branches are horizontal, ascending only at the ends, the secondary branches are usually erect, secund. The leaves, in tufts, are often very large, being 16 inches long by 6 inches broad, with about 30 pairs of nerves. The fruits protrude but slightly from the fleshy receptacle.

LEGUMINOSÆ.

Crotalaria retusa, *Linn. Dingla.*

A small shrub up to 6 feet high. Flowers very beautiful, Laburnum-like, yellow in long terminal racemes.

Erythrina stricta, *Roxb. Pangara* ; *Coral tree.*

Only in Karla village. Leafless in flower. Stem and branches excessively prickly. Flowers bright scarlet. This tree is commoner and larger below ghats.

Butea frondosa, *Konig. Palas.*

Small, lopped trees are very common.

Dalbergia sympathetica, *Nimmo. Pendgul.*

Moderately large climber ; stem and branches usually armed with strong thorns. Flowers copious, but of an inconspicuous white colour.

Pongamia glabra, *Vent. Karanj* ; *Indian Beech.*

Not in the woods, but a common road-side tree. There seem to be two varieties here ; one with pale buds and larger white flowers in few flowered racemes, the other with dark buds and smaller rosy flowers in denser racemes. The leaves of the first also appear to be larger.

Mezoneuron cucullatum, *W. & A.*

An enormous climber in Lonavla wood ; stems up to 1½ feet in girth, bark smooth, prickly tubercles bluntly conical, large, sub-spirally arranged. Flowers beautiful, yellow, in large panicles. Pods dull red thin, flat, papery. This plant is also very common in the jungles round the Duke's Nose, but there it only clambers among small trees and bushes.

Saraca indica, *Linn. Ashok.*

A tree with beautiful orange flowers, only seen at the temple in Lonavla grove.

Tamarindus indica, *Linn.* *Amli*; *Chinch*; *Tamarind.*

A few small trees at Karla. Flowers appear with the leaves; buds on some trees pink, on others white.

Entada scandens, *Bth.* *Garambi.*

An enormous climber, stem attaining 3 feet in girth. Flowers yellow, minute, absurdly out of proportion to the pods which are often 3 feet long by 8 inches or more broad.

Acacia concinna, *D.C.* *Sikukai.*

A large climbing shrub; flowers minute in innumerable round heads. Fruits used as soap.

Albizzia stipulata, *Boiv.* *Uduli.*

A fine large deciduous tree, reaching 70 feet in height, stem clear for 20 or more feet, girth 8½ to 10 feet. The profusion of rosy flower heads and delicate foliage combine to render this one of the most gracefully beautiful of trees.

COMBRETACEÆ.

Terminalia belerica, *Roxb.* *Beheda.*

Tree 50 to 70 feet high, stem clear for 10 or more feet, with a girth of 5 to 13 feet. The young foliage is red. In the mornings the flowers exhale a nauseous odour which taints the air for some distance.

Terminalia Chebula, *Retz.* *Hirda.*

A tree as large as the foregoing. Fruit smooth, ribbed, constituting the myrobolans of commerce.

Calycopteris floribunda, *Lam.* *Akshi.*

A climbing shrub with large panicles of small greenish flowers.

The calyx becomes greatly enlarged in fruit. It is yellowish, developing to ruddy brown in colour, so that the plant is very conspicuous while in fruit. It is very common along the railway below Khandala.

Combretum ovalifolium, *Roxb.* *Madbel.*

Combretum extensum, *Roxb.* *Piloka.*

These are sometimes very large climbing shrubs bearing, with or before the young leaves, an abundance of small, yellow flowers which are succeeded by brown fruits with papery wings.

MYRTACEÆ.

Psidium Guyava, *Linn.* *Peru*; *Guava.*

This is a naturalized denizen of the area. I have never seen it produce good fruit in this wild condition. It sheds its bark almost as freely as Eucalyptus.

Eugenia Jambolana, *Lam.* *Jambúl.*

The finest trees are 30 to 80 feet high, stem clear for 10 feet, girth 5 to 10 feet. Very common, specially in a stunted state. Fruit reddish, turning to black, with scanty, aromatic pulp. Some Europeans make a cordial from these fruits. I observed that the trees on Sakar Pathar were in ripe fruit, while those in the woods below were still in flower.

MELASTOMACEÆ.

Memecylon edule, *Roxb.* *Anjan* ; *Lokhandi.*

Very common, usually forming thickets on the outskirts of the woods. Height about 15 to 20 feet, stem clear from 2 to 8 feet, girth 1 to 2 feet ; wood very dense, bark dark brown, with close, shallow tessellated furrows, trunk crooked and short, branches spreading and twisting, leaves tea-like but entire. Flowers a beautiful dark blue (or, in a solitary example, white) ; when the petals fall the remaining parts are of a rose colour for some time. Not one of the numerous plants of this species in these woods is infested with parasites, but at Sakar Pathar it is attacked by a form of *Loranthus cuneatus* which has leaves exactly simulating those of its host. I saw, however, one plant of identically the same form on a *Pisa* (Actinodaphne Hookeri).

Memecylon sp.

In the wood between Lonavla and Karla there is a Memecylon unknown to me. It may be one of the new species indicated by Mr. Talbot. The leaves are usually narrower than in *M. edule ;* the flowers are much smaller and appear to be yellowish ; the calyx tube is deeper and the ripe fruit is yellow.

The natural reproduction of both species is excellent. The stems of even very young seedlings have brown, detachable, thin bark and they are as tough and supple as wire.

CACTEÆ.

Opuntia nigricans, *Haw.* *Prickly Pear.*

In small scattered clumps about Karla. In this plant the plane surfaces of the branches face east and west, while the edges point north and south. This is particularly noticeable when it is used as a hedge to enclose all four sides of a compound as at many Travellers' Bungalows.

RUBIACEÆ.

Stephegyne parvifolia, *Korth.* *Kadam.*

A rare tree in Lonavla wood. Flowers in globose heads, subtended by two leaf-like bracts.

Randia dumetorum, *Lamk.* *Ghela.*

A common spiny shrub. Flowers small, white, turning yellow. Fruit green, about 1 inch in diameter.

Canthium umbellatum, *Wight.* *Tupa.*

A small, dense tree. Leaves shining, rather large and leathery, with distinct pits in the axils of the nerves beneath. Flowers yellowish in very dense clusters.

Vangueria spinosa, *Roxb.* *Alu.*

A dense tree, 20 feet high, with a girth of 5 feet. Foliage dark green, shining. Fruits up to 1⅜ by 1⅝ inch, green, smooth with a slight bloom, apex with a small circular areole, surrounded by 5 very small calyx teeth. These fruits taste like crab-apples.

Ixora parviflora, *Vahl.* *Kurat* ; *Torch Tree.*

A tall, bushy shrub or small tree, with rather inconspicuous white flowers. The green wood burns readily.

Ixora nigricans, *Br.* *Kat Kura.*

A very small shrub in Lonavla grove. The pure white flowers turn black before falling, and the whole plant also becomes black when dried.

Pavetta indica, *Linn.* *Papti.*

Ragged bush, seldom more than 2 to 4 feet high, with fine heads of narrow-tubed white flowers. This plant possesses but does not preserve all the qualifications essential to enable it to rank as ornamental. The flower heads are generally perfect, but the leaves are represented by tattered fragments. The ubiquitous cattle must be held responsible for this.

COMPOSITÆ.

Vernonia indica, *Clarke.*

A small shrub with terminal heads of purple flowers, white pappose in fruit.

SAPOTACEÆ.

Sideroxylon tomentosum, *Roxb.* *Kúmbal.*

A very common, small, thorny tree.

Mimusops Elengi, *Linn.* *Bokúl.*

A tree 30 feet high, stem clear for 8 feet, girth 7½ feet ; with very fragrant flowers.

EBENACEÆ.

Diospyros montana, *Roxb.* *Goinda.*

Several trees in Lonavla wood ; height 25 feet, stem clear for 6 feet, girth 7 feet. Easily recognized in fruit by the enlarged leaf-like calyx lobes.

OLEACEÆ.

Jasminum arborescens, *Roxb.* *Kúsúr.*

A scandent shrub with pretty white flowers which exhale the strong, sweet scent characteristic of Jasmines. In open situations, where it has no opportunity to climb, it becomes an erect shrub with drooping branches.

Linociera intermedia, *Wight.*

Common tree, up to 20 feet in height, stem clear for 9 feet, with a girth of 2½ feet. Flowers in short clusters, yellowish, scented. Fruits black, intensely bitter.

Olea dioica, *Roxb.* *Párjamb.*

A tree 30 feet high, stem clear for 8 feet, girth 2½ feet, resembling the last-named, but more loosely branched and flowers in open terminal panicles.

Fruits also intensely bitter, usually eaten *once* incautiously as Jambúl.

APOCYNACEÆ.

Carissa Carandas, *Linn.* *Karwanda* ; *Corinda.*

A large, thorny shrub, well known to all. The flavour of the fruit reminds me of blae berries.

Carissa suavissima, *Bedd.*

A large climber, otherwise very like the last-named.

Rauwolfia densiflora, *Bth.* *Kúra.*

A deciduous bush, about 3 feet high, in Lonavla wood.

Wrightia tinctoria, *Br.* *Nagal Kúra.*

A small shrub near Karla village. Flowers white with a corona of fringed scales, appearing with the leaves which yield Indigo.

Anodendron paniculatum, *A. DC.* *Lamtani.*

Common in all the woods, but the finest specimens are to be seen in that near the Tower of Silence. It is an enormous *twiner* and one, strangling a mango tree, must be over a foot in diameter. The bark is brown, thick and rather smooth. The latex is watery, slightly tinted yellow and not viscous. The flowers are very small, yellow, in large open panicles.

BORAGINEÆ.

Cordia Myxa, *Linn.* *Bhokar.*

A few trees in Lonavla wood. The leaves have tufts of hairs in the axils of the nerves beneath.

BIGNONIACEÆ.

Heterophragma Roxburghii, *DC.* *Waras.*

One tree at Karla. It is common on stony slopes on the ghats. The fruits, at first maroon coloured, turn black. The seeds, including the wings, are often 2½ inches long.

Stereospermum chelonides, *DC.* *Mersing.*

A tall tree in Lonavla wood. Throat of corolla dark yellow with brown blotches and streaks, limb light buff with dark streaks.

ACANTHACEÆ.

Strobilanthes ixiocephalus, *Bth.*

A shrub, particularly common in the wood between Lonavla and Karla. The flowers are very pale blue and the whole inflorescence becomes hairy and viscid in fruit.

Adhatoda Vasica, *Nees.* *Adúlsa.*

A very common plant, especially near villages.

VERBENACEÆ.

Lantana Camara, *Linn.* *Tantani.*

A prickly hedge plant with orange flowers, fortunately with no tendency to spread and become a nuisance in this area. Fruits black, in small clusters at the tips of the branches which are leafless in the hot weather. Butterflies are very partial to this bush.

Callicarpa lanata, *Linn.* *Kan phuli.*

A tree 25 feet high, with a girth of 2½ feet, rather rare here, but common in ghat thickets. Leaves densely woolly. Flowers small crowded, of a beautiful rose-purple colour.

Premna coriacea, *Clarke.* *Chambari.*

Usually described as a climber. In Lonavla wood it seemed to me to be always truly epiphytic in the manner of a young fig, and the roots, closely appressed to the trunk of the host, were never long enough to reach the ground.

Vitex Negundo, *Linn.* *Nirguri.*

As this avoids shade it is common only in the more open parts of the woods.

LABIATÆ.

Colebrookia oppositifolia, *Linn.* *Bhamini.*

A common shrub. Ripe fruits in spikes "like squirrels' tails."

LAURINEÆ.

Machilus macrantha, *Nees.* *Gúrúmb.*

A common tree reaching 50 feet in height, stem clear for 12 feet, girth up to 12½ feet. Leaves with the glaucous hue characteristic of many laurels. Fruits globose, ¾ inch in diameter, black with a grape-like bloom, pulp scanty and dark green, greedily eaten by crows, There are two forms of this tree : one with smaller, rather coriaceous leaves, the other with larger, more membraneous leaves.

THYMELACEÆ.

Lasiosiphon eriocephalus, *Dcne.* *Rameta.*

A willow-like shrub or tree, very ornamental with its balls of bright yellow flowers.

ELÆAGNACEÆ.

Elæagnus latifolia, *Linn.* *Amgúli.*

A climber, becoming very large ; branches often spiny. The scales on the leaves form most beautiful microscopic objects. The acid fruits which are also covered with these scales, are eaten.

LORANTHACEÆ.

Loranthus longiflorus, *Desrouss.* *Wanda.*

Very common, especially on Mango.

Loranthus loniceroides, *Linn.*

Almost equally common.

Viscum capitellatum, *Sm.*

A dwarf, leafy shrub, parasitic on other members of Loranthaceæ. The two first-named parasites are particularly common wherever there are Mango trees. Jambul, Gúrúmb, Anjan and Uduli and all the figs, except the Pipra, remain free from their attacks. They often form very large masses, their sucker roots intercepting all the nutriment of the support, so that the parts beyond them quickly die. In addition to the suckers first produced, they throw back runners for some distance along the branches and stems of their victims, and these runners drive in a close array of suckers. From the fact that these parasites bear foliage of their own, we may infer that the nutriment drawn from the tissues of the host requires further elaboration before being of service to themselves. The leafless species of *Viscum* or Mistletoe have sunk to a greater depth of degradation, as some of their members are merely bundles of jointed branches (phylloclade or not in their function) with unisexual flowers of simple design. One—Viscum capitellatum—has leaves and it is actually parasitic on its own relations !

On Sakar Pathar I found Memecylon edule (*Anjan*) infested with a form of *Loranthus cuneatus*, the leaves of which in appearance almost exactly simulated those of its host. (This may bear the name, *variety* decipiens.) On one plant of Pisa (*Actinodaphne Hookeri*) I found exactly the same form, but everywhere else there was only the usual yellow, narrow-leaved variety of the *Loranthus*.

In Kanara I have seen *Loranthus tomentosus* growing on and resembling *Randia dumetorum* (*Ghela*), *Sideroxylon tomentosum* (*Kúmbal*) and *Zizyphus Jujuba* (*Bori*). *Loranthus longiflorus* and *L. loniceroides* often have elongated leaves on the Mango. There is no apparent reason why these parasites should sometimes simulate their hosts, and it is difficult to believe that living on the same *elaborated* food should be the cause of the resemblance. It is a subject which may repay investigation.

SANTALACEÆ.

Osyris arborea, *Wall.* *Lotar.*

A large shrub with glaucous foliage. The fruit is of the size of a pea and yellow. I recollect seeing a note of Dr. Cooke (I think) to the effect that he considered this plant parasitic—usually on *Carissa Carandas* (*Karwanda*).

EUPHORBIACEÆ.

Euphorbia neriifolia, *Linn.* *Khande lidúng.*

Commoner on the ghâts where it grows into a weird tree.

One specimen measured at Sakar Pathar was about 15 feet high, stem 4 feet in girth, and the diameter of the whole plant was 60 feet. The branches were very long and spreading, but all seemed to proceed from one central stem.

Bridelia retusa, *Spreng.* *Asana.*

The low level Konkan variety bears flowers in long sub-terminal spikes. This, the ghât form, has its flowers in dense axillary fascicles. Its stem, when young, is either thorny or quite unarmed.

Glochidion lanceolarium, *Dalz.* *Bhoma.*

A small, twiggy shrub with hard green, distichous leaves. In our area it is a ragged object; on the ghâts it is often a very ornamental large shrub.

URTICACEÆ.

Holoptelea integrifolia, *Planch.* *Walvi.*

There are a few small trees of this at Karla. The seeds taste like those of Beech.

Celtis tetrandra, *Roxb.* *Brumaj.*

A few trees in Lonavla wood.

Morus alba, *Linn.* *Tút*; *Mulberry.*

Not a denizen of the woods, but a common fruit tree in gardens at Lonavla where it grows and fruits admirably.

Ficus gibbosa, *Bl.* *Datir.*

An epiphytic shrub in Karla.

Ficus bengalensis, *Linn.* *Wad* : *Banyan.*

A common roadside tree with ærial roots. One variety of this plant seen with pendulous branchlets, large succulent leaves, and fruits one inch in diameter, orange coloured, flecked with dark red.

Ficus mysorensis, *Heyne.* *Bhar* ; *Nahir.*

Epiphytic on Mango and Gúrúmb, of noble proportions and appearance. The trunk of one at Karla is 23 feet in girth. Fruit, one inch in diameter, quite smooth when ripe, bright orange, flecked with white.

Ficus retusa, *Linn.* *Nándrúk.*

Not an actual denizen of the woods, but the common roadside tree of Lonavla. It produces adventitious roots in great abundance.

Ficus religiosa, *Linn.* *Pipal.*

A large, well-known, epiphytic tree.

Ficus Tsiela, *Roxb.* *Pipra.*

An epiphytic tree with very smooth, gray green bark. It produces very few ærial roots.

Ficus asperrima, *Roxb.* *Karvat.*

A small tree, not epiphytic. *Leaves* very rough, often 3-lobed. Often bears its small fruits on bare branches.

Ficus glomerata, *Roxb.* *Umbar.*

A common tree, not epiphytic. Fruits large, red when ripe, in hanging clusters on the stems and branches, edible but rather insipid.

The epiphytic figs usually germinate on the forks of branches and make but little growth, until some of their roots reach the ground when they increase rapidly. Karla wood is especially rich in trees of this kind. There may be seen examples of *F. gibbosa* growing on *F. glomerata*, and towards the south end of the wood an extreme case is presented, where a *F. religiosa* has completely enveloped an *Anjan* of which now only a solitary branch protrudes ; a plant of *F. Tsiela* has attained moderate dimensions on the Pipal. Which will conquer time alone can show ; but *F. Tsiela*, being *outside*, scores so much in its own favour. I cannot recollect ever having seen Figs grow on one another elsewhere, but it is probably a common occurrence.

An epiphytic fig, when young, seems to cling timidly to its host ; at a later age it assumes a most murderous attitude. *Ficus Tsiela* is the only fig here infested with *Loranthi.* It also often forms witches' brooms which result from fungoid attacks.

A colony of flying foxes reside in the Karla wood, and these animals are probably responsible for the large number of epiphytic figs. There is also a large colony in the Empress Gardens at Poona, and the Superintendent once formed an interesting collection of young trees—mostly figs—from seeds introduced from the ghâts by the flying foxes. The Banyan, of which some trees are always to be found in fruit, appears to be their principal food plant. I have seen or heard of very few instances of Banyan or other epiphytic fig seeds germinating in the ground, and then only in flower pots.

Artocarpus integrifolia, *Linn.* *Phanas* ; *Jack.*

This does not seem to fruit very freely here.

SALICINEÆ.

Salix tetrasperma, *Roxb.* *Wallúng.*

On roadsides. This is the only representative of the willow family native to the Bombay Presidency.

GNETACEÆ.

Gnetum scandens, *Roxb.* *Kúmbal.*

A very large climber, girth of stem often 3 feet. Fruits glaucous blue, in clusters like large grapes.

PALMÆ.

Caryota urens, *Linn.* *Mhar* ; *Fish-tail Palm.*

A tall, handsome, well-known palm, with bipinnate leaves.

GRAMINEÆ.

Bambusa arundinacea, *Retz.* *Bans* ; *Bamboo.*

The large, thorny bamboo.

Oxytenanthera monostigma, *Bedd.* *Uda.*

A small bamboo grown at Karla. Culms scattered, velvetty when young. Very common on the ghâts.

THE CLASSIFICATION OF THE *LEPIDOPTERA PAPILIONINA.*

By

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Partly owing to the fact that most Indian Lepidopterists have confined their attention to one group only and partly because most of the prophets of the cult have been too busy multiplying and dividing each other species to pay attention to anything else, the classification of the Indian *PAPILIONINA* is in a particularly chaotic condition.

In most of the handbooks in use it would appear that the authors were ignorant that Darwin had ever lived and written or at any rate that they had not grasped the particular application of his discovery to their own subject.

Now it should be an axiom that classification should have for its object the grouping of genera and families in their natural order of descent and relationship to each other and a system which does not satisfy this criterion cannot be worth maintaining.

A true classification can therefore only be formed by tracing the development of the various organs and characters of the insect throughout the order and discovering which are the important and constant features which can be relied on.

Certain general principles, however, must be a guide to any system : (1) A lost character cannot be reproduced though it may be compensated in some other way in cases where there has been a reversion to primitive habits or surroundings ; (2) a rudimentary organ is rarely re-developed ; (3) no new organ can be produced except as a modification of some previously existing structure.

And in applying these it should be borne in mind (i) that characters which are adaptive that is liable to have been effected or affected by external influences through natural selection are, as a rule, very untrustworthy. For instance colour and outline, hairs or spines on the larvæ, genital organs of imagos, can be of but slight importance in defining groups ; (ii) secondary sexual characters should rarely be used to define genera—if for no other reason on account of the difficulties they place in the way of the student—but in cases where a large number of allied species fall naturally into two groups and are yet not easily separated by any other characters there is no scientific reason why they should not be used ; (iii) characters distinguished by degrees of comparison, unless the difference is capable of actual measurement and is constant to the practically same extent in all the species grouped under them are similarly unsatisfactory.

It will be seen at once that in Lepidopterous insects the neuration of the wings is likely to be of exceptional value as being least exposed to external influences and experience shows that this is the case. Except in the case of the more degraded groups of the *TINEINA* and of the **Pterophoridae** there are singularly few instances where any important modification can be directly attributed to an alteration in the shape of the wing. It may be added that in no other order is it so easy to trace the philogeny by this means as in the Lepidoptera.

The most generalised group in the Lepidoptera is admittedly the *MICROPTERYGINA*. The gap between these and the next most primitive forms is undoubtedly wide; but the descent from the Tineidæ —through the **Heterogeneidae**—of the **Thyrididae** in which family we must recognise the ancestors of the *PAPILIONINA* is clear and continuous.

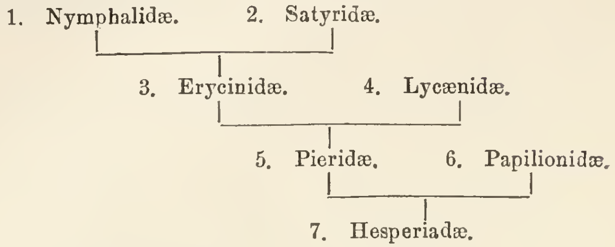
The *PAPILIONINA* are at present a rather isolated group though the gap between the oldest forms of the **Hesperiadae** and the **Thyrididae** is probably not greater than that between the former and the rest of the group. Nearly all the peculiar characteristics of the group can be traced more or less directly to adaptation to diurnal habits and this is particularly marked in the later forms.

CHARACTERS.—Head, ocelli and maxillary palpi obsolete, tongue and labial palpi developed, antennæ simple more or less dilated apically—typically with a regular formed club. F.W. 1 a. and 1 c. absent 1 b. simple H.W. without frenulum, 1 c. absent, 8 rising out of cell near base thence rapidly diverging.

The 7 families may be tabulated as follows :—

1.	With all the veins present and separate	**7 Hesperiadae.**
	With 2 or more veins stalked or coincident. .	2
2.	Both sexes with the anterior legs aborted ...	3
	Anterior legs developed in one or both sexes.	4
3.	Vein 12 of F.W. greatly dilated at base	**2 Satyridae.**
	„ „ not „ „	**1 Nymphalidae.**
4.	Anterior legs of the ♂ aborted..................	**3 Erycinidae.**
	„ „ „ ♂ developed	5
5.	Anterior tarsi of the ♂ more or less abbreviated or with one or both claws absent...	**4 Lycaenidae.**
	Anterior tarsi normal, claws present	6
6.	Vein 1 a of H.W. present	**5 Pieridae.**
	„ „ „ absent	**6 Papilionidae.**

The following is a key to the *PHILOGENY* :—



Family I. Nymphalidae—

CHARACTERS.—Anterior legs much reduced, useless for walking. Vein 5 from middle of transverse vein or approximated to 6 H.W. with præcostal spur.

This is a large and extremely interesting family. The species while being for the most part very closely allied in structure yet exhibit an extraordinary diversity in form, colour and habits.

THE INDIAN GENERA MAY BE TABULATED AS FOLLOWS :—

1.	H.W. cell tubularly closed 3 and 4 separate..	2
	,, 3 and 4 from a point or stalked, or cell open	8
2.	F.W. 10 out of 9	3
	,, 10 free or from a point with 9 only ...	4
3.	H.W. 6 and 7 stalked	**41** Pareba, *Dbld.*
	,, ,, separate	**42** Telchinia, *Hb.*
4.	F.W. 5 from middle of transverse vein	5
	,, ,, more or less approximated to 6 at base......	7
5.	F.W. 11 anastomosing with 12	**43** Hestia, *Hb.*
	,, 11 free	6
6.	Claws without paronychia or pulvilli	**44** Danais, *Latr.*
	,, with ,, & ,, ...	**45** Euploea, *Fb.*
7.	F.W. 9 rising free from 8, anastomosing with 10, 10 with 11, 11 with 12	**40** Parantirrhœa *W-M.*
	9 out of 8, no anastomosis	**39** Melanitis, *Fb.*
8.	Club of antennæ short broad abrupt	9
	,, ,, long, gradual, usually slight.	20
9.	3 and 4 of F.W. separate	10
	,, ,, from a point or stalked ...	14
10.	Eyes smooth	11
	,, hairy	13
11.	F.W. 2, 3 and 4, nearly equidistant at base..	12
	,, space between 3 and 4 less than ½ that between 3 and 2	**10** Hypolimnas, *Hb.*

12.	Cell closed	**3** Argynnis, *Fb.*
	„ open	**1** Melitæa, *Fb.*
13.	H.W. cell open	**11** Symbrenthia, *Hb.*
	„ „ closed	**12** Vanessa, *Fb.*
14.	Cell of both wings open	15
	„ „ slenderly closed	19
15.	F.W. 10 out of 9	**6** Helcyra, *Feld.*
	„ „ free	16
16.	Antennæ short	17
	„ long $=\frac{1}{2}$ or more	18
17.	Anterior tarsus of ♂ $= \frac{1}{2}$ tibia. Antennæ club very broad.	**7** Junonia, *Hb.*
	„ „ „ $= \frac{1}{3}$ tibia. Antennæ club not very broad	**8** Precis, *Hb.*
18.	H. W. 6 and 7, separate	**4** Rhinopalpa, *Feld.*
	„ „ from a point	**9** Hestina, *Westwd.*
19.	Eyes simple	**2** Atella, *Dbld.*
	„ hairy	**5** Terinos, *Boisd.*
20.	Cell of H. W. tubularly closed	21
	„ „ lineally closed or open	24
21.	F.W. 6 at some distance from 7 at base ...	**38** Anadebis, *Butl.*
	„ 6 and 7 closely approximate or from a point	22
22.	F.W. 3 and 4 widely separate	23
	„ „ closely approximate	**26** Parthenos, *Hb.*
23.	Antennæ long, about $\frac{1}{2}$	**36** Penthema, *Westw.*
	„ short, barely $\frac{1}{3}$	**37** Calinaga, *Mre.*
24.	F.W. 3 and 4 widely separate	25
	„ „ closely approximated, from a point or cell open	35
25.	F.W. 11 free to costa	26
	„ „ anastomosing or coinciding with 12 after origin	29
26.	F.W. 4 nearly straight	27
	„ „ highly angulated	28
27.	F.W. 10 out of 9	**25** Xanthotænia, *Westw.*
	„ „ free	**18** Charaxes, *Ochs.*
28.	F.W. 10 out of 9	**27** Amathusia, *Fb.*
	„ „ free	**29** Stichophthalmia, *Feld.*

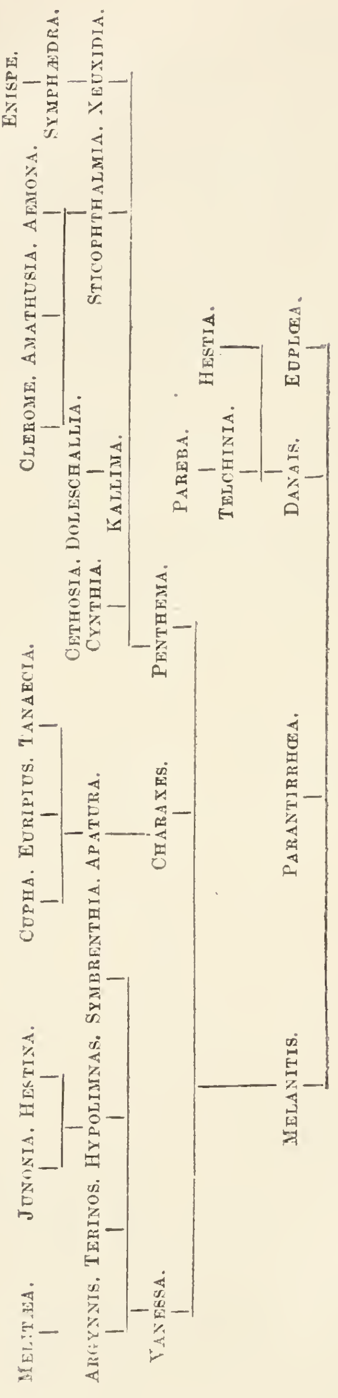
29.	F.W. 11 anastomosing with 12, but becoming free again	**28** Æmona, *Hew.*
	„ „ coinciding with 12 after origin	30
30.	F.W. 10 absent	**30** Enispe, *Westw.*
	„ „ present	31
31.	F.W. 10 coinciding with 11 after origin	32
	„ „ free to costa	33
32.	F.W. 4 nearly straight	**34** Discophora, *Boisd.*
	„ „ broadly bent	**31** Thaumantis, *Hb.*
33.	F.W. cell only lineally closed	**32** Symphædra, *Hb.*
	„ „ „ tubularly closed	34
34.	F.W. 4 regularly curved	**33** Xeuxidia, *Hb.*
	„ „ „ straight	**35** Prothœ, *Hb.*
35.	F.W. 5 and 6 nearly parallel	36
	„ „ more or less approximated at base	41
36.	Both cells completely open	**21** Doleschallia, *Feld.*
	„ „ not „ „	37
37.	F.W. 10 out of 9	38
	„ „ free	39
38.	Cell of H.W. completely open	**19** Cynthia, *Fb.*
	„ „ „ lineally closed	**20** Cethosia, *Fb.*
39.	F.W. 3 and 4 only approximated at base	**24** Dichorraggia, *utl.*
	„ „ from a point	40
40.	F.W. 9 and 10 from a point	**23** Pseudergolis, *Feld.*
	„ „ separate	**22** Kallima, *Westw.*
41.	F.W. 9 and 10 talked	42
	„ „ separate, or 8 of H. W. not reaching termen	44
42.	F.W. cell open	**15** Euripus, *Westw.*
	„ „ lineally closed	**13** Cupha, *Billb.*
43.	F.W. 11 and 12 anastomosing	**16** Tanaæcia, *Butl.*
	„ „ separate	45
44.	F.W. cell closed, 3 and 4 stalked	**14** Cirrhochroa, *Dbld.*
	„ „ 3 and 4 from a point, or cell open	**17** Apatura, *Fb.*

NOTES ON THE ABOVE—

(1). Under the Genus APATURA a large number of species are included which many naturalists have tried to separate into a number of genera. In so large a number there is naturally some variation in structure, particularly in those directions towards which the whole family shows a tendency such as for instance the abortion of the outer margin of the cell. But the divisions based on these differences are evidently not natural ones. A number of Indian species have been included in the Genus LIMENITIS but do not agree with that genus in characters. There are apparently no true LIMENITIS in India.

(2). SYMPHÆDRA as restricted here contains but two Indian species.

(3). The genera are numbered in accordance with their apparent order of descent. The following table sufficiently explains the philogeny of the principal genera:—


Melitæa.
Junonia.
Hestina.
Cupha.
Euripius.
Tanaecia.
Clerome.
Amathusia.
Aemona.
Enispe.
Argynnis.
Terinos.
Hypolimnas.
Symbrenthia.
Apatura.
Cethosia.
Doleschallia.
Symphædra.
Cynthia.
Sticophthalmia.
Xeuxidia.
Kallima.
Vanessa.
Charaxes.
Penthema.
Pareba.
Telchinia.
Hestia.
Melanitis.
Parantirrhœa.
Danais.
Euplœa.

Family II. Satyridae—

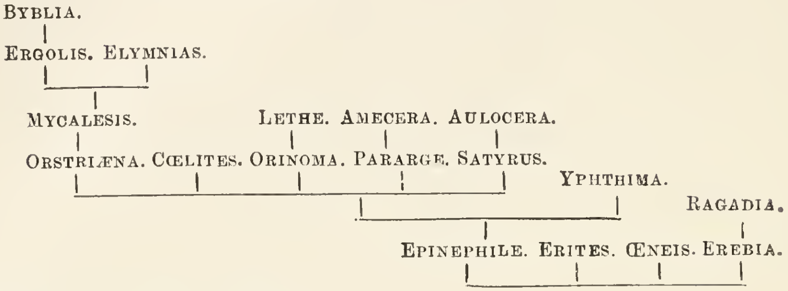
CHARACTERS.—As in the Nymphalidæ but vein 12 of F.W. (and sometimes the upper and lower margins of cell and 1 b.) greatly dilated at base.

TABULATION OF GENERA:—

1.	F.W. 3 and 4 from a point or stalked	2
	,, ,, separate	3
2.	Club of antennæ developed	**1** BYBLIA, *Hb.*
	,, ,, ,, slight	**2** ERGOLIS, *Boisd.*
3.	F.W. 3 and 4 closely approximated	**3** ELYMNIAS, *Hb.*
	,, ,, widely separate	4
4.	H.W. 3 and 4 closely approximated or stalked	5
	,, ,, well separate	11
5.	Eyes naked	6
	,, hairy	8
6.	Palpi clothed in front with appressep hairs..	**6** COELITES, *Westw.*
	,, ,, ,, ,, porrect hairs	7
7.	Head tufted in front	**5** ORSTRIÆNA, *Wallen.*
	,, not tufted in front	**7** NEORINA, *Westw.*
8.	N.W. 3 and 4 stalked	**10** AMECERA, *Butl.*
	,, ,, from a point or approximated	9
9.	F.W. apex of cell broadly rounded	**9** ORINOMA, *Dbld.*
	,, ,, ,, angulate	10
10.	F.W. 5 and 6 subparallel	**11** PARARGE, *Hb.*
	,, 5 approximate to 6	11
11.	F.W. Lower margin of cell and 1 b. swollen at base	**4** MYCALESIS, *Hb.*
	,, vein 12 only swollen	**8** LETHE, *Hb.*
12.	F.W. 10 out of 9	13
	,, 10 separate	14
13.	F.W. with lower margin of cell dilated at base	**14** YPHTHIMA, *Hb.*
	,, ,, ,, ,, ,, simple	**18** RAGADIA, *Westw.*
14.	F.W. with lower margin of cell dilated at base	15
	,, ,, ,, ,, simple	17
15.	Middle tibiæ short with apical spines	16
	,, , normal	**15** EPINEPHILE, *Hb.*
16.	F.W. lower margin of cell only slightly dilated	**12** AULOCERA, *Butl.*
	,, ,, ,, greatly dilated.	**13** SATYRUS, *Fb.*
17.	F.W. 6 and 7 only approximated	18
	,, from a point	**19** EREBIA, *Dalm.*

18.	Middle and hind tibiæ clothed with long loose hair	**17** Œneis, *Hb.*
	Middle and hind tibiæ not clothed with long loose hair	**16** Erites, *Westw.*

TABLE OF PHILOGENY:—



Family III. Erycinidae—

CHARACTERS.—Anterior legs of ♂ reduced, useless for walking, in ♀ well developed. Posterior tibiæ without middle spurs. F.W. 8 and 9 out of 7, 5 from middle of transverse vein or approximated to 6. H.W. with præcostal spur.

TABULATION OF GENERA:—

1.	Palpi very long; longer than head and thorax.	**1** Libythea, *Fb.*
	„ „ short	2
2.	3 and 4 of H.W. connate	**2** Zemeros, *Boisd.*
	„ „ separate	3
3.	Eyes naked	**3** Taxila, *Westw.*
	„ hairy	**4** Abisara, *Feld.*

Zemeros may be considered a development from Taxila. The other three are parallel developments. The family, though now nowhere very extensive, is chiefly characteristic of South America, in the old world it is poorly represented.

Family IV. Lycaenidae—

CHARACTERS.—Anterior tarsi of the ♂ more or less abbreviated or with one or both claws absent. Otherwise as in the Pieridæ.

The family, though containing a large number of very closely allied species, forming a distinct homogeneous series, is exceedingly difficult to define except by the above character. The connection with the Pieridæ is very close, particularly in those species which have vein 7 of the F.W. present. In general vein 6 of F.W. rises from the apex of the cell.

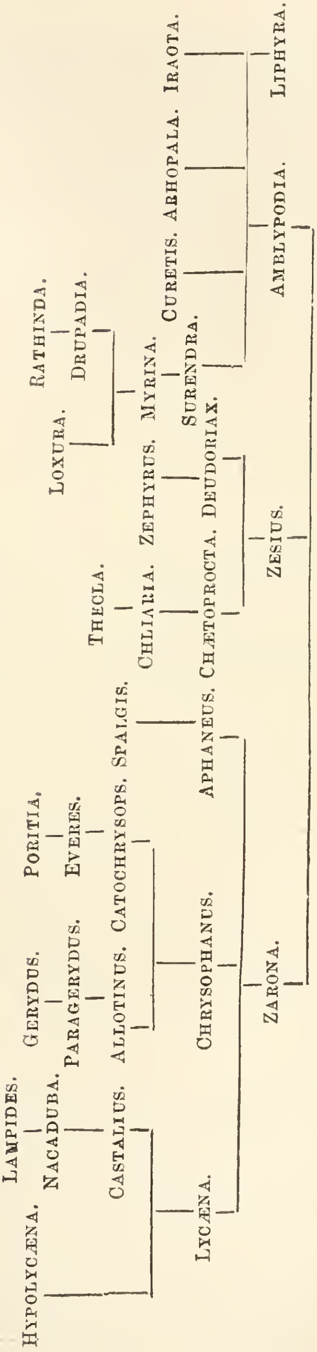
TABULATION OF GENERA:—

1.	Lower margin of cell straight or only slightly curved	2
	Lower margin of cell angulated at origin of vein 2	18

2.	F.W. with vein 7 present	**17** Zarona, *de N.*
	,, ,, ,, absent	3
3.	Legs abnormal	4
	,, normal	7
4.	Legs very long, tarsi abnormal, 1st joint elongated	5
	,, short, tibiæ with apices incrassated	**6** Logania, *Dist.*
5.	F.W. vein 6 out of 8	6
	,, ,, 6 and 8 from a point	**9** Allotinus, *Feld.*
6.	First joint of tarsi widened and compressed	**7** Gerydus, *Boisd.*
	,, ,, ,, lengthened only	**8** Paragerydus, *Dist.*
7.	Antennæ with a distinct well defined club	9
	,, gradually thickened	8
8.	Antennæ half	**16** Aphaneus, *Hb.*
	,, less than half	**15** Spalgis, *Mre.*
9.	Eyes hairy	10
	,, smooth	14
10.	F.W. vein 8 absent	**1** Hypolycæna, *Feld.*
	,, ,, 8 present	11
11.	F.W. veins 11 and 12 connected by a bar	**2** Lampides, *Hb.*
	,, ,, ,, not connected by a bar	12
12.	,, ,, ,, anastomosing	**3** Nacaduba, *Mre.*
	,, ,, ,, not anastomosing	13
13.	,, ,, ,, more or less approximated after origin	**4** Castalius, *Hb.*
	F.W. veins 11 and 12 not approximated	**5** Lycæna, *Fb.*
14.	F.W. with vein 8 absent	**10** Neolycæna, *de N.*
	,, ,, ,, ,, present	15
15.	F.W. veins 11 and 12 completely coinciding after origin	**11** Poritia *Mre.*
	F.W. veins 11 and 12 not completely coinciding after origin	16
16.	F.W. veins 11 and 12 anastomosing	**12** Everes, *Hb.*
	,, ,, ,, not anastomosing	17
17.	,, ,, ,, more or less approximated after origin	**13** Catochrysops, *Boisd.*
	F.W. veins 11 and 12 not approximated after origin	**14** Chrysophanus, *Hb.*
18.	Antennæ with well developed differentiated club	19
	Antennæ gradually thickened only, usually slightly	23

19.	F.W. 9 absent	20
	„ present	21
20.	Eyes simple	**19** Chliaria, *Mre.*
	„ hairy	**18** Thecla, *Fb.*
21.	F.W. 6 out of 8	**21** Zephyrus, *Dalm*
	„ 6 not out of 8	22
22.	F.W. 6 and 8 connate	**20** Chætoprocta, *de N.*
	„ „ approximated only	**22** Deudorix, *Hew.*
23.	F.W. 7 present in both sexes	**33** Liphyra, *Westw.*
	„ 7 not present in both sexes	24
24.	F.W. 7 present in ♂	25
	„ 7 absent in both sexes	27
25.	F.W. 5 out of 6	**31** Iraota, *Mre.*
	„ 5 and 6 separate	26
26.	F.W. 9 apex of cell rounded, 6 and 8 widely separate	**32** Amblypodia, *Horsf.*
	Apex of cell angulate, 6 and 8 connate	**23** Zesius, *Hb.*
27.	F.W. 9 absent	28
	„ 9 present	29
28.	F.W. 11 curved upward towards 12	**25** Rathinda, *Mre.*
	„ 11 straight	**26**
29.	Apex of cell rounded, 6 and 8 widely separate at base	**30** Arhopala, *Boisd.*
	Apex of cell angulate	30
30.	F.W. 6 and 8 closely approximate or connate	**27** Myrina, *Gdt.*
	„ „ wide apart at base	31
31.	Antennæ short, palpi$=\frac{1}{2}$, F. W. cell apex acutely angled	**24** Loxura, *Horfs.*
	Antennæ moderate, cell not acutely angled.	32
32.	Palpi porrect	**28** Surendra, *Mre.*
	„ suberect	**29** Curetis, *Hb.*

PHILOGENY:—


HYPOLYCÆNA.
LAMPIDES.
GERYDUS.
PORITIA.
LOXURA.
RATHINDA.
NACADUBA.
PARAGERYDUS.
EVERES.
DRUPADIA.
CASTALIUS.
ALLOTINUS.
CATOCHRYSOPS.
SPALGIS.
THECLA.
CHLIARIA.
ZEPHYRUS.
MYRINA.
CURETIS.
ARHOPALA.
IRAOTA.
LYCÆNA.
CHRYSOPHANUS.
APHANEUS.
CHÆTOPROCTA.
DEUDORIAX.
SURENDRA.
ZARONA.
ZESIUS.
AMBLYPODIA.
LIPHYRA.

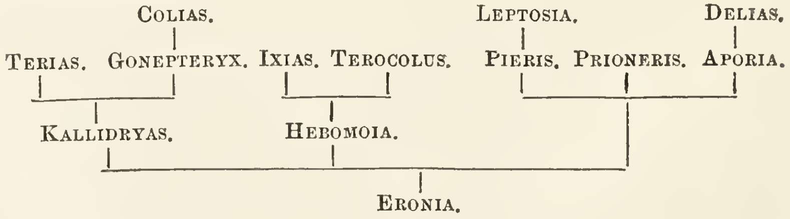
Family V. Pieridae—

CHARACTERS.—Anterior legs normally developed in both sexes F.W. 2 or more veins stalked or absent. Vein 5 from middle of transverse vein or approximated to 6 at base. H.W. 1a present.

TABULATION OF GENERA :—

1.	H.W. without developed præcostal spur......	2
	„ with „ „ „	5
2.	F.W. 10 free, 6, 7 and 8 stalked (9 absent)	3
	„ 10 out of 8	**2** Colias, *Fb.*
3.	F.W. 5 from middle of the cell	4
	„ 5 approximate to 6 at base	**3** Gonepteryx, *Lch.*
4.	H.W. cell subtriangular, 7 from near apex...	**1** Terias, *Swainson.*
	„ cell ovate, 7 from upper margin	**4** Kallidryas, *Boisd.*
5.	F.W. 9 absent	6
	„ 9 present	**13** Xeronia, *Hb.*
6.	Terminal joint of palpi short......................	7
	„ „ „ long	8
7.	H.W. spaces between 5, 6 and 7 subequal ...	**5** Ixias, *Hb.*
	„ 5 and 6 approximate at base................	**6** Teracolus, *Hb.*
8.	F.W. 10 absent...	9
	„ present..	10
9.	F.W. 5 and 6 connate	**8** Leptosia, *Hb.*
	„ 5 and 6 separate at base	**11** Delias, *Hb.*
10.	F.W. 6 and 7 closely approximated at base	**7** Hebomoia, *Hb.*
	„ „ stalked	11
11.	Club of antennæ developed	12
	„ „ slight	**12** Aporia. *Hb.*
12.	Costal margin serrate beneath	**10** Prioneris.
	„ „ smooth	**9** Pieris, *Schrk.*

PHILOGENY :—



I have treated Pieris as a large genus containing a number of species usually separated under several genera which cannot be satisfactorily defined.

Family VI. Papilionidae—

CHARACTERS.—F.W. vein 5 approximated to 4 at base. 1b with a short spur to inner margin. H.W. 1a absent. Anterior legs fully developed. This a very distinct strongly marked family, both in structure and appearance rather isolated from the rest of the group.

TABULATION OF GENERA :—

1.	F.W. 10 absent	**1** Parnassius, *Gm.*
	„ 10 present	2
2.	F.W. 7, 8 and 9 stalked	**2** Leptocercus, *Swan.*
	„ 9 separate	3
3.	H.W. 8 connected by a bar with cell	**3** Armanda, *Atk.*
	„ not connected by a bar with cell	4
4.	F.W. 6 approximate to 7. Palpi long	**4** Teinopalpus, *Hope.*
	6 from middle of ansverse vein. Palpi short	**5** Papilio, *L.*

PHILOGENY.—The first four genera may be regarded as parallel developments from the last.

Family VII. Hesperiadae—

CHARACTERS.—Anterior legs fully developed in both sexes. All the veins in both wings present and separate.

TABULATION OF GENERA :—

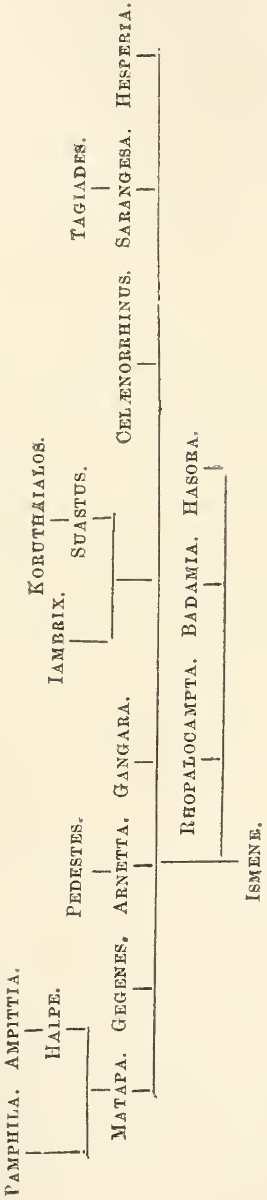
1.	F.W. vein 5 approximated to 4	2
	„ „ not approximated to 4	13
2.	H.W. vein 5 rudimentary	3
	„ „ fully developed	12
3.	Antennæ club truncate	**44** Hesperia, *Fb.*
	„ „ acuminate	4
4.	F.W. in ♂ with costal fold	**46** Achalarus, *Scudder.*
	„ „ without „	5
5.	Palpi terminal joint suberect	6
	„ „ „ porrect	7
6.	F.W. 3 close to end of cell	**39** Celænorrhinus, *Hb.*
	„ „ some distance from end of cell	**38** Charmion, *de N.*
7.	Cell of F.W. more than $\frac{2}{3}$	**35** Hantana, *Mre.*
	„ „ less „ „	8
8.	♂ with a tuft of hair on anterior coxæ	**36** Caprona, *Wallen.*
	♂ without „ „ „ „ „	9
9.	♂ legs nearly naked	**42** Tagiades, *Hb.*
	♂ posterior tibiæ hairy	10
10.	Hairs on posterior tibiæ developed into a tuft.	11
	„ „ „ „ not „ „ „	**40** Odina, *Mab.*

11.	Lower margin of cell of F.W. straight	**41** Coladenia, *Mre.*
	„ „ „ „ „ curved between veins 2 and 3..............................	**43** Sarangesa, *Mre.*
12.	♂ with costal fold	**45** Orthopætus, *Watson.*
	♂ without costal fold	**37** Calliana, *Mre.*
13.	F.W. 5 from middle of transverse vein	14
	„ 5 approximated to 4 at base	33
14.	Terminal joint of palpi long, slender porrect.	15
	„ „ „ „ not long slender and porrect	19
15.	H.W. vein 5 rudimentary	**47** Rhopalocampta, *Wall.*
	„ „ developed	16
16.	H.W. vein 3 from end of cell	17
	„ „ well before end of cell	**48** Badamia, *Mre.*
17.	Club long, moret han ½ antenna	**51** Ismene, *Swanson.*
	„ shorter, less than „ „	18
18.	F.W. 1b distorted at base	**49** Hasora, *Mre.*
	„ „ not distorted at base	**50** Bibasis, *Mre.*
19.	Terminal joint of palpi long, slender erect, curved over vertex..............................	20
	Terminal joint of palpi short, not curved over vertex	23
20.	F.W. 11 approximated to and almost touching 12.....................	21
	„ 11 free not approaching 12................	22
21.	H.W. vein 3 from close to end of cell...	**33** Suada, *de N.*
	„ „ „ from well before end of cell ...	**31** Koruthaialos, *Watson.*
22.	F.W. vein 3 from end of cell	**34** Iambrix, *Watson.*
	„ „ 3 from well before end of cell ...	**32** Suastus, *Mre.*
23.	F.W. 11 approximated to 12 after origin...	24
	„ 11 and 12 well apart	26
24.	Terminal joint of palpi concealed in 2nd ...	**22** Sanchus, *de N.*
	„ „ „ „ porrect visible	25
25.	F.W. vein 2 nearer end of cell than base...	**7** Baracus, *Mre.*
	„ „ 2 nearer base than end of cell...	**8** Astictopterus, *Feld.*
26.	Terminal crook of antennæ short or absent.	27
	„ „ „ „ double the width of the club...	29
27.	Terminal joint of palpi erect......................	**30** Isoteinon, *Feld.*
	„ „ „ porrect	28
28.	Terminal joint of palpi conspicuous	**24** Arnetta, *Watson.*
	„ „ „ concealed	**26** Zographetus, *Watson.*

29.	F.W. 2 equidistant between base and end of cell	**61**	MATAPA, *Mre.*
	,, 2 nearer base than end of cell		30
30.	♂ with sexual brand on upper side of F.W.	**28**	PUDICITIA, *de N.*
	♂ without ,, ,, ,, ,, ,, ,,		31
31.	H.W. in ♂ with veins 2 and 3s wollen	**25**	GANGARA, *Mre.*
	,, ,, ,, ,, ,, not ,,		32
32.	F.W. vein 3 more than twice as far from 2 as 4.	**29**	ACERBAS, *de N.*
	,, ,, 3 less than ,, ,, ,,	**27**	ERINOTA, *Mab.*
33.	Antennæ very long, terminal crook, short		34
	,, moderate or short		35
34.	H.W. 3 from well before end of cell	**10**	KERANA, *Dist.*
	,, 3 close to end of cell	**9**	PIRDANA, *Dist.*
35.	Antennæ very short less than ½, crook minute		36
	,, moderate		37
36.	Antennæ=breadth of thorax	**20**	GEGENES, *Hb.*
	,, =nearly twice breadth of thorax	**3**	ERYNNIS, *Schrk.*
37.	Antennæ terminal crook, long about twice breadth of club		38
	,, terminal crook not or hardly more than breadth of club		41
38.	♂ with a tuft of hair on anterior coxæ	**12**	PITHAURIA, *Mre.*
	♂ without ,, ,, ,, ,, ,,		39
39.	F.W. 3 closely approximated to 4		40
	,, 3 not approximated to 4	**13**	HIDARI, *Dist.*
40.	F.W. in ♂ vein 2 swollen	**11**	CRETEUS, *de N.*
	,, ,, ,, not swollen	**14**	LOTONGUS, *Dist.*
41.	Posterior tibæ without middle spurs	**20**	CYCLOPÆDES.
	,, ,, with ,, ,,		42
42.	F.W. vein 2 much nearer base than end of cell		43
	,, ,, not nearer base than end of cell		45
43.	H.W. 2 much nearer end of cell than base	**15**	ACTINOR, *Watson.*
	,, vein 2 from about middle or nearer base		44
44.	♂ with secondary sexual characters	**2**	AUGIADES, *Hb.*
	,, without ,, ,, ,,	**16**	UDASPES, *Mre.*
45.	Terminal joint of palpi suberect distinct		46
	,, ,, ,, porrect more or less concealed		47
46.	F.W. in ♂ with sexual brands	**1**	PAMPHILA, *Fb.*
	,, ,, ,, without sexual brand	**4**	AMPITTIA, *Mre.*

47.	H.W. vein 3 from end of cell	**23**	PEDESTES,
	„ „ „ before end of cell...........		*Watson.*
48.	F.W. vein 3 from midway between 2 and 4 ...		48
	„ „ „ approximated to 4		49
49.	H.W. 3 closely approximated to 4		50
	„ 3 not „ „	**5**	HALPE, *Mre.*
50.	H.W. 7 nearer end of cell than origin of 8 ...	**17**	ONRYZA, *Watson.*
	7 nearly equidistant between 8 and	**18**	BAORIS, *deN.*
	end of cell	**19**	ITON, *Mre.*

The Philogeny is extremely difficult and not easy to illustrate from the Indian fauna alone. The following table gives a scheme of the principal genera.


Pamphila.
Ampittia.
Halpe.
Matapa.
Gegenes.
Pedestes.
Arnetta.
Gangara.
Iambrix.
Koruthaialos.
Suastus.
Celænorrhinus.
Tagiades.
Sarangesa.
Hesperia.
Rhopalocampta.
Badamia.
Hasora.
Ismene.

"KILLS" BY CARNIVOROUS ANIMALS: BEING SOME REMARKS ON THE METHOD OF THEIR IDENTIFICATION.

(BY W. A. WALLINGER, DIVISIONAL FOREST OFFICER, DHARWAR.)

It was with no small amount of diffidence and trepidation that I originally submitted, in a paper read before this Society, a set of maxims which appeared to me to govern panther and tiger "kills," arrived at by a system of close observation during a series of years (Vol. XIII, Journal, Bombay Natural History Society).

It is barely necessary to represent that a correct and prompt diagnosis of a "kill," wherever seen, is of the greatest possible importance to the sportsman. It would make this paper too long if an effort were once more made to differentiate between "kills" by panthers and tigers and those directly attributable to the other carnivora commonly found in India. I must restrict my energies, therefore, to shewing that the maxims originally drawn up for the guidance of the tyro in large game shooting are sufficiently accurate to be of *some* practical value.

The subject has always been full of interest to me, and as I am able to corroborate in a material degree the more important contentions, I ask the permission and tolerance of the members present to allow me to repeat these maxims here and to then proceed to show how the desirable verification referred to has been brought about.

Maxims regulating Panther and Tiger "Kills."

The following are given in the order of their importance :—

(*i*) Marks of the four canine teeth are always clearly observable on the throat.

(*ii*) The carcase is dragged, and not—save under exceptional circumstances—lifted.

(*iii*) The carcase is usually moved, even if not in an exposed position.

(*iv*) An effort is made to hide the carcase either (*a*) by depositing it in a *nullah*, (*b*) up a tree, or (*c*), by deliberately covering it with leaves, grass and other *débris*.

(*v*) The region of the pelvis is the point from which the consumption of the carcase is started, the tendency being to work towards the chest.

(*vi*) The skin and even long hair is consumed.

(*vii*) The stomach is never ruptured, nor are the intestines injured.

(*viii*) The outline of the unconsumed portion of the carcase, when seen early enough, is remarkably even and clean: the ribs looking like the work of a butcher's saw.

(*ix*) Signs on the ground of a struggle for life on the part of the animal killed, or even of extreme terror before death, are usually absent.

(*x*) Marks of claws may be visible on the shoulders or elsewhere.

(*xi*) Blood is conspicuous by its absence, both in the carcase, and around the "kill."

As to whether a particular carcase is the property of a tiger or a panther, in the total absence of pugs, we have nothing, so far as I am aware, to guide us, except —

(*a*) The size of the teeth marks.

(*b*) Their relative interval or distance from each other.

(*c*) The size of the animal killed, and

(*d*) Other information of the presence of a tiger in the vicinity.

Case 1.—*December* 2*nd*, 1901.

There had been several "kills" previous to my arrival in camp. Panthers were reported to occupy a small range of hills, and a spot along the base was selected in which to tie up. The same night the goat was killed, and next afternoon I went through what, at that time, I considered one of the most interesting experiences possible. Let me explain that what we all considered to be the best position was occupied by another gun, while, with my wife, I got into a small "banyan" tree some 80 yards from the "kill" over a second goat. At that time no idea of systematically taking observation had been formulated. Before twilight had set in we heard a rumbling to our right not twenty paces off. Owing to the sloping hill-side the noise proceeded from almost the same level as that occupied by ourselves, and the deep gurgling, somewhat awe-inspiring, sound made by two panthers, gradually increased in volume though nothing was visible because of the thick undergrowth. After a few moments, occupied apparently in deciding who was to do the killing, out *sprang* a panther a distance of quite twenty feet and seized, with the utmost neatness, the throat of the goat, the impetus throwing both to the ground. At this stage I put an end to the business. It is worth while to here observe that this is the second time, in my experience, that the female has been allowed to kill while the male remained passive.

From this case we gathered two facts :—

(*a*) That where there is no suitable cover, in which to creep close up, the panther takes a spring on to its prey, and

(*b*) That the throat is the part seized at once.

Case 2.—

My milk goats were out grazing on the borders of some jungle quite adjacent to our camp when one of them was seized at about 1 p.m., and rescued by the plucky conduct of a very old dame who had charge of them. The four wounds made by the canine teeth were on the throat, close behind the jaw, and the goat was carried into camp in a dejected condition.

The same day at about 4-45 p.m., with a mind intent on observation, we selected a tree in which to sit. It was not a suitable tree, in that our *matchan* was far too greatly exposed. To hide behind a huge bundle of leaves, in a deciduous teak tree, with practically no leaf on it, shows a want of commonsense. A small quantity undoubtedly helps to hide the structure, where a larger number would be liable to suddenly draw attention to the position. I enter upon the question of our position being unavoidably exposed at some length, because, it has, as will be seen, an unfortunate bearing on the sequel.

Towards the end of December the moon was three-quarters full, so I hoped to be able to see clearly enough to make our subsequent notes accurate. Unfortunately a misty haze prevailed combined with a few drifting clouds. We naturally selected an open space, but the cover on three sides of us—south, east and west—was quite thick; that on the south extending to within a few paces of the "tie." The undergrowth I refer to here consisted of that extremely hardy, prickly, persistent, and valueless perennial, the Lantana (*Lantana scandens*), a plant introduced, it is believed, as a rare flowering shrub by some misguided lover of gardens, and one which now bids fair to bring under its all-absorbing influence large areas of land on which something better might be grown.

Well, after sunset, while the moon was partially hidden by one of the passing clouds referred to, I saw what looked like a long dark shadow gradually emerge from the very thick lantana on the south side and seize the goat, after a spring of not more than nine feet, again neatly by the throat. There was no sound beyond that created by the collapse of the goat and the landing of the panther. There never is. We sat and intently watched that panther with its jaws firmly fixed in the goat's throat. Presently the goat gave a convulsive shudder—the only movement we discerned—and all was over. The panther, who was lying down, raised itself with the goat's throat still in its mouth, and with a quick turn of its neck threw the head away, and it fell with a dull, sickly thud on to the leaf-laden ground. The critical moment had now arrived, and we no longer escaped observation. I had hoped to see the brute start feeding, but this was not to be, for almost at once his gaze fell on us and he bolted. This case, therefore, illustrated nothing more than what we had, to all intents and purposes, seen and noted before.

Case 3.—

The end of March offers opportunities in parts of the Dharwar District not easily to be beaten. April brings with it a succession of thunderstorms which end in filling every excavation with water and in keeping them filled. Two hot weathers ago I remember to have noticed, when too late, the existence of an unusual spring on high-lying ground surrounded by forest reserves, and quite two miles from the nearest inhabited village. This spring, emerging from two separate points on a small hillside, fed a "Nulla" with two branches, and disappeared subterraneously after traversing a distance of about 150 yards. I had dammed up the lower section when water was so scarce the year before with great success and benefit to the surrounding villagers who were thus able to water their famishing cattle. The spot was, in many respects, an ideal one for my present purpose. An enormous banyan tree (*Ficus bengalensis*) was available; panthers constantly drank there, and all that was necessary was the cutting of the tall tufted grass in a strip to give us a clear view from the tree.

On the night of the 23rd March last I had a "kill"; the conditions were essentially favorable; the moon was all but full, and water elsewhere very scarce.

6-5 p.m.—In position in two *matchans* well sheltered by leaves; chetal "belling" to our left; slight breeze from the same side (west); my wife, watch in hand, entering all times.

6-26 p.m.—Suddenly saw a goodsized panther standing bolt up-right to the right in the grass and in full view. He was looking from side to side with the evening sun shining on his beautiful glossy skin. Might have been standing thus for a few seconds before we actually saw him; and almost immediately he started the stalk. The grass being of some length there was very little crouching at first; the approach was slow and noiseless; the distance from the bait about thirty yards. Getting behind some lantana we could not, for the moment, see the panther from our position, although Mr. M., who was also with us, could do so. Presently he stealthily emerged from the other side now in the crouching attitude. Ever and anon he looked from side to side furtively. He approached the goat behind a tuft of grass to-within two paces. The goat, so far, had shown no knowledge of its danger. The wind was all against this; but now she turned round and met the gaze of the panther within six feet of her nose, and immediately the panther half sprang and half ran out, jumped on her back and seized the throat—which part we could not at once tell—over the right shoulder, and turning the head round in a second we saw the panther's head come up with the throat in its mouth. The entire stalk had occupied four minutes, *i.e.*, 6-26 to 6-30 p.m., at which moment the seizure took place.

So far the following points had, it will be seen, been established :—

1. In the absence of a companion, the stalk is a quiet and stealthy process.

2. The victim is consequently (and almost invariably) unaware of its impending death.

3. There is practically no spring if the cover available will permit the animal to stalk right up.

4. The victim is seized by the throat, and

5. There is no roar nor any noise from the goat.

To continue.—The panther sat with its prey in its mouth from 6-30 to precisely 6-38 p.m. The goat offered no resistance whatever, except during the final slight dying throes, after which the throat was relinquished. During this entire period, in the broad daylight, the panther kept on the extreme alert. He turned his head, even with the goat in his mouth, from side to side and listened intently. The only perceptible sound was when the panther appeared, on several occasions shortly after the seizure, to tighten his grip. The head of the goat at 6-38 p.m. was half dropped and half flung to one side, and the panther sat bolt upright over the carcase looking to the west (up wind). During this period he redoubled his vigilance.

At 6-45, the panther quietly bent down and licked the blood on the goat's throat at the point where it had been seized.

It was still broad daylight.

At 6-46 the panther walked about ten paces from the "kill" and again sat down and licked the blood which had stained his own shoulder. At 6-50 p.m. he relaxed to some extent the extreme vigilance so far displayed and lay down, a magnificent sight. Tired of the position he turned over and faced our *matchans*. There were still, to our minds, two very important observations to make, and the fear of being seen was, at this time, considerable.

At 7 p.m., however, quietly getting up (that is after a rest of ten minutes, after killing, during which time the breathing of the panther shewed that he had been suffering from the great heat of the day), he strolled to the "kill." He seized it by the throat—dropped it—seized it by the back—dropped it—again seized it by the throat and tried to walk off, dragging the carcase between the fore legs. The goat had been tied in the rational way, by the hind leg, to an iron peg, by a double rope about two feet in length, well hidden by thorns. This rope held firm. Seeing that it was useless to try and drag, the panther now sniffed the posterior of the goat and deliberately turning the hind leg over so as to get the goat almost on its back, *started to eat at the pelvis.* I regret that this time was not recorded, as my wife got too interested and forgot to make the note.

It was not till 7-7 p.m. in the uncertain light that Mr. M. took his shot and missed. The beast had been in full view, at this time, for forty-one minutes, and I have now to record the fact that that panther was at that kill again at 7-12 p.m. The moon though giving a splendid light was somewhat low down, with the result that the kill was in deep shadow. Accurate shooting was out of the question, so with the aid of a powerful pair of binoculars I watched the panther feed till 7-40 p.m. All the time while feeding at the hind quarters the panther kept on the alert. He took a mouthful, looked up, listened and then went at it again. Just as the moon would have given us a fair shot he got up and walked away. Mr. M. saw him go to the water close at hand, drink, spring over the stream, and disappear.

The points established may now be summed up as follows:—

(1) The process of "killing" takes time, although the animal is apparently insensible from the first.

(2) Strangulation—not dislocation of the vertebræ—is the direct cause of death.

(3) There is an instinctive desire to drag the carcase away.

(4) The position occupied by the carcase when being dragged is evidently between the two front legs, and

(5) The point at which a panther starts to feed is evidently at the pelvis.

Further in this case—

(*a*) the panther came up wind (probably by accident);

(*b*) drank after killing and not before;

(*c*) the blood on the wounded throat was licked, as well as that which streamed down over the panther's shoulder.

Conclusion.—There were several minor observations worth recording. The discrimination displayed by the panther throughout, in the matter of sounds, was most impressive: something that would cause us to start was absolutely ignored, while, on the other hand, a distant, almost inaudible, sound would make the panther suddenly turn. The dropping of dry wood or the berry of the *ficus*, on which we were seated, with a crash into the deposit of dry leaves in the "nulla" below us caused him to move no muscle. We appeared to be on the high road to the roosting ground of the common crow, several of whom spotted the affair and, circling round, cawed vigorously. This did not in any way annoy or disconcert the panther. This conduct on the part of the crow was significant and interesting, and shews with what accuracy Sir Samuel Baker wrote: "A caw after sunset and later near a 'kill' means that a panther is visible."

It would have been nice to have been able to definitely clear up the point regarding the "sucking of blood," for there is much difference of opinion about it. Although we were not more than twenty paces from the kill it was impossible to tell for *certain* whether any sucking was in progress or not—we all thought not. I had binoculars available; but unfortunately never thought of using them at that early stage.

The naked eye, unless at very close quarters indeed, will not reveal the movement of the thorax caused by the act of swallowing. The point is of no practical value to the sportsman in the matter of diagnosing "kills," but it is nevertheless of some academical interest.

As regards killing (Condition IX) it is relevant to state that the goat is not *always* killed at once. It is grasped by the throat tight enough to prevent its bleating or struggling, but a panther will sometimes hold its prey like this for a little time before putting its strength into the grip. On the other hand, when killing a larger animal, a panther exerts the strength of its jaws at once. Calves and heifers seldom recover from the wound on their throats, unless rescued almost at once, whereas goats and dogs are known frequently to do so without even a puncture visible.

A CATALOGUE OF THE *HETEROCERA* OF SIKHIM AND BHUTAN,

By G. C. Dudgeon, F.E.S.,

With Notes by H. J. Elwes, F.R.S., &c.,

and

Additions by Sir George Hampson, Bart., B.A., F.E.S., &c.

Part XV.

(Continued from page 763, Vol. XIV.)

Family EPICOPIIDÆ.

Genus Epicopia, Westw.

3017. *E. polydora*, Westw.

Sikhim and Bhutan, 2,000—5,000 feet. This is not uncommon in parts of Darjeeling, flying during the day and sucking the flowers of tea and other plants in the manner of Papilionidæ of the *philoxenus* group. Its action of settling upon flowers with its wings steady, instead of quivering, makes it generally recognisable from the Papilionidæ at a short distance. I have found it most commonly at Tukvar and at Badamtam, where I also procured the larva which is white and curiously dotted with long waxy efflorescence. (I think it is quite possible, as Mr. Dudgeon says of *E. philenora*, that this species and the next may be one, but my own knowledge of them is insufficient.—*H. J. E.*)

3018. *E. philenora*, Westw.

Sikhim and Bhutan, 2,000—5,000 feet. Rather rarer than the last I think, but found with it and having the same habits. It resembles one of the black Papilionidæ, probably most like *P. astorion,* Westwood. The hind wings of both this species and the last vary extremely in shape and markings, and I think it probable that they may both be found referable to one species. This cannot be proved, however, until they have been bred upon a large scale. The moth flies throughout the monsoon on bright days.

Family URANIIDÆ.

Genus Nyctalemon, Dalman.

3019. *N. patroclus*, Linn.

Sikhim and Bhutan, 1,800—2,500 feet. Rather rare. I have only seen it on the wing on three occasions. Once in the valley of the Chel river, in British Bhutan, flying by day in a shady ravine, and twice disturbed from low herbage and flying in bright sunlight at

Punkabaree. I have specimens in my collection from Burma, Upper Assam, Manipur and the Andaman Islands, as well as from the above localities.

Genus Urapteroides, Moore.

3020. *U. astheniata*, Guen.

Sikhim. I have never taken this.

(I also have never seen this from Sikkim, though it seems common in the Naga hills.—*H. J. E.)*

Genus Strophidia, Hübn.

3021. *S. fasciata*, Cram.

Sikhim and Bhutan, 1,800 feet. I took this at light in June and October at Punkabaree. It seems to be rather scarce, though it is possible that it may have been overlooked by me among the numerous specimens of *Pseudomicronia oppositata*, Snell, which species it much resembles in appearance. (I have specimens from Möller's collection taken in March and April.—*H. J. E.)*

Genus Acropteris, Hübn.

3022. *A. striataria*, Clerck.

Sikhim and Bhutan, 2,500—6,000 feet. Occurs rather commonly from May to August. It is attracted to light and may occasionally be seen flying round low-growing plants on dull days.

3023. *A. obliquaria*, Moore.

Sikhim and Bhutan, 2,500—5,000 feet. Occurs commonly from May to September.

3024. *A. iphiata*, Guen.

Sikhim and Bhutan, 5,000 feet. I have only taken this in June attracted to light. The hind wing has the outer margin rounded; the markings on both wings are arranged as in *A. striatavia*, Clerck. In one of my specimens the submarginal band on the hind wing is obsolete. (I should have said that this was as common or commoner than the last. I have taken it in September.—*H. J. E.)*

Genus Pseudomicronia, Moore.

3025. *P. oppositata*, Snell.

Sikhim and Bhutan, 5,000 feet. This species occurs in September and October; also I expect earlier in the year. It has the habit in common with others of the family of resting with its wings outspread on the under surface of leaves, and it sometimes may be found settled in this manner upon the surface of a white-washed wall. (I have it from Möller, dated April.—*H. J. E.)*

Genus MICRONIA, Guen.

3027. *M. aculeata*, Guen.

Sikhim and Bhutan, 1,800—6,000 feet. This is the commonest insect of the family and may be taken at light or by beating low jungle from March to October. The striations on the forewings of different specimens vary in extent considerably. (A specimen from British Bhutan in February is one-third smaller in size than the average.—*H. J. E.)*

Genus CHATAMLA, Moore.

3028. *C. flavescens*, Wlk.

Sikhim and Bhutan, 4,500—6,000 feet. I have only two specimens of this brought in by my collectors from Nim and Lingtu in British Bhutan; they are dated April and August. (A rare species of which I have 2 ♂ and 1 ♀. The figure in moths of India, Vol. III., p. 118, marked ♂ is, I think, certainly a ♀. Both my males, which differ much from each other in colour, have pectmated antennæ and are smaller than the ♂.—*H. J. E.)*

Genus AUZEA, Wlk.

3029. *A. rufifrontata*, Wlk.

Sikhim and Bhutan. Brought in by my collectors, dated April and June. I know nothing of the elevation at which it occurs. (I took it at Mongpoo at about 4,000 feet on May 25th, but it is not a common species.—*H. J. E.)*

3030. *A. arenosa*, Butl.

Sikhim, 5,500 feet. I took one specimen of this at Tukvar at light in April 1889, but have not seen another since. (I have four from Sikhim and two from the Naga Hills, which are much greyer in colour than those from Sikhim.—*H. J. E.)*

3031. *A. hyperthyra*, Hmpsn.

Sikhim. I do not know this species. (A very distinct species of which the unique type is in my collection.—*H. J. E.*)

3032. *A. torridaria*, Moore.

Bengal (fide Hampson). As the species of the genus seem to be confined to the hilly portions of India it is probable that the present species, if it occurs in Bengal at all, will be found in the Sikhim and Bhutan Hills. I have one male from Kanara, which has a hyaline streak below the origin of vein 5 of the hindwing, which feature does not appear to be present in the female (*vide* description).

Family EPIPLEMIDÆ.

Genus Amana, Wlk.

3039. *A. angulifera*, Wlk.

Sikhim, 1,200 feet. This species was brought in by my collectors on one occasion only and said to have been caught at Sivoke on the Teesta. It has hitherto only been recorded from the Khasia Hills. The date of the capture of my specimen was not recorded. (This must be very rare in Sikhim, whence I have only a single specimen from Möller's collection. One from the Nagas has the yellow band on the hindwing above unbroken.—*H. J. E.)*

Genus Orudiza, Wlk.

3040. *O. protheclaria*, Wlk.

Sikhim and Bhutan, 1,800—3,000 feet. I have eleven specimens taken at light by me at Punkabaree and Fagoo in June, July, August and September. I do not think it is a common insect anywhere within the above limits.

Genus Epiplema, Herr Schäff.

3041. *E. columbaris*, Butl.

Bhutan, 2,500 feet. I took one specimen at Fagoo in July. The ground colour of both wings is more purplish-brown than hair brown ; the cilia ochreous. It is easily distinguishable from other species of the genus.

3041*a*. *E. inhians*, Warr.

Sikhim, 1,800 feet. I have three males and four females taken at light by me at Punkabaree in May, June, September and October. The antennæ in the male are thickened and flattened, the hindwing in both sexes bears an elongate white C-shaped mark in the cell.

3041*b*. *E. retracta*, Hmpsn.

Sikhim. The only specimen obtained by me was the type which is in the British Museum collection.

3042. *E. edentata*, Hmpsn.

Sikhim. I have not seen this from Sikhim. I have one specimen from Kanara, in S.-W. India, which is typical. This proves that although rare it has a wide range. (A very distinct species of which I have seen only the type specimen from Sikhim.—*H. J. E.)*

3043. *E. reticulata*, Moore.

Sikhim. I have only taken this in the Kangra Valley, Punjab, in September at 5,000 feet elevation. (Very rare in Sikhim. I have only two specimens, one of which is from the Atkinson collection.—*H. J. E.)*

3045. *E. sreapa*, Swinh.

Bhutan, 3,000 feet. I took one female at Fagoo at light in September 1894.

3046. *E. multistrigaria*, Moore.

Sikhim and Bhutan, 4,500—7,000 feet. This is a very common insect occurring at a much higher elevation than the other species of the genus, with the exception of *E. nivea*, Hmpsn., and *E. bicaudata*, Moore, which are found at over 10,000 feet.

3048. *E. rhagavata*, Wlk.

Sikhim. The insects in my collection originally identified as this species by Sir George Hampson have been determined by me as the females of *E. pectinicornis*, Dudgn. I have not seen *E. rhagavata*, Wlk., from this locality.

3051. *E. obscuraria*, Moore.

Bhutan, 3,000 feet. I have only one specimen of this, which I took at light at Fagoo in August.

3053. *E. conflictaria*, Wlk.

Sikhim. I cannot recognise this. Two specimens which I had hitherto placed under this name, I am convinced on re-examination are extreme dark cold-weather forms of *E. instabilitata*, Wlk., which very variable species can always be recognised by the form of the dentation of the lower margin of the subcostal pale area of the hindwing. (I have two specimens, one of which from Atkinson's collection is *E. lilacina*, Moore, which Sir G. Hampson identifies with *E. conflictaria*, Wlk. After reading Mr. Dudgeon's remarks on No. 3060, I think he is probably right.—*H. J. E.)*

3055. *E. ruptaria*, Moore.

Sikhim and Bhutan, 1,800—3,000 feet. The specimens from these localities have the markings more pronounced than those from the Kangra Valley, Punjab, in my collection. The latter more nearly approach *E. fulvilinea*, Hmpsn. The only really constant feature by which *E. fulvilinea*, Hmpsn., seems to differ from this species is the position of the submarginal black speck on the forewing, which is developed nearer the costa in *fulvilinea* than it is in *ruptaria*. I have five specimens taken in June, July and August.

3056. *E. fulvilinea*, Hmpsn.

Sikhim and Bhutan, 2,500 feet. Taken commonly at light in May, June, July and August. (My own experience is similar, but I would not call it common.—*H. J. E.)*

3057. *E. apicalis*, Hmpsn.

Sikhim and Bhutan, 2,500—3,000 feet. I have taken this at light in May and September, and the markings seem constant; the very faintly-marked hindwing with the nebulous dark patch just beyond the end of the cell are characteristic of the species.

3058. *E. bicaudata*, Moore.

Sikhim and Bhutan, 2,500—3,000 feet. Occurs but rather rarely in May, June and August. It shews less variation in markings than do *E. restricta*, Hmpsn., and E. *instabilitata*, Wlk. (This is much the commonest *Epiplema* in Sikhim at high elevations, 7—10,000 feet, and comes freely to light in June and July in the station.—*H. J. E.)*

3059. *E. restricta*, Hmpsn.

Sikhim and Bhutan, 1,800—3,000 feet. A common insect from April to August. I have one specimen in my collection, which is without the subapical dark patch on the forewing and only bears a few indistinct yellowish markings on the costa and a discocellular dark spot similar to that found in some specimens of the next species. (Again we see how an insect which may be generally rare, as this certainly is in Sikhim, may be common in particular places or in particular seasons.—*H. J. E.)*

3060. *E. instabilitata*, Wlk.

Sikhim and Bhutan, up to 3,500 feet. The commonest form occurring in June, July and August has the forewing pure white with a dusky mark at the end of the cell followed by a yellow patch, and sometimes some indistinct postmedial yellow and dark patches. Specimens, taken late in August and September, have the forewings more completely suffused with yellow and brownish markings, and a more or less distinct postmedial row of blackish spots. A specimen taken in October is so completely suffused with brown that only the posterior margin of the forewing and the costal area of the hindwing shew whitish. Another specimen taken in March has the dark area of the hindwing entirely dark brown and the yellow markings on the forewing almost wanting. The species can always be recognised by the hindwing having the costal area white defined by a yellow or brown border on the lower side of an irregularly dentate but constant formation. The dark brown or yellow portion of the hindwing always extends to above the middle of the inner margin.

3061. *E. himala*, Butl.

Sikhim and Bhutan, 5,000—7,000 feet. Occurs in April, May and June.

3061*b*. *E. nivea*, Hmpsn.

Sikhim, 12,000 feet. Differs from *E. himala*, Butl., in the markings being much reduced and the suffusion on the underside of the forewing in the form of two narrow bands.

3061*a*. *E. argentisparsa*, Hmpsn.

Sikhim and Bhutan, 1,800—2,500 feet. Taken at light by me at Punkabaree and Fagoo in February, June and September. I have only seen four specimens. The wings beyond the postmedial line are more or less irrorated with bluish grey scales; this extends sometimes over the entire surface of wings.

3062. *E. ocusta*, Swinh.

Sikhim and Bhutan, 1,800—3,000 feet. Occurs rarely in June and July. I have only four specimens taken at light.

3063c. *E. pectinicornis*, Dudgeon MS. in Hmpsn. Moth's Ind. IV., p. 549.

Male with antennæ bipectinated and a fovea at the base of the cell on the forewing; hindwing with the base of the costa lobed covering the frenulum.

Grey brown; vertex of the head white; wings indistinctly striate throughout. Forewing with an antemedial erect rufous line, sometimes indistinct; a postmedial dark brown line bordered on each side with paler, angled at the costa and below the cell; a submarginal lunulate dark mark below the apex. Hindwing with antemedial rufous line in continuation of the one on the forewing; a postmedial rufous line defined by dark brown on the inner side acutely angled at vein 4; a whitish marginal line defined on both sides by dark brown; a rufous streak running up from the tail at vein 4 parallel to the postmedial line; three black spots outlined with rufous between veins 5 and 2. The area of the hindwing between the postmedial line and the outer margin is often suffused with leaden grey.

Sikhim and Bhutan, 1,800—3,000 feet. Twenty-six specimens taken at light from May to September. *Exp.* 25—27 mm.

3063*d*. *E. rufimargo*, Warr.

Sikhim. It is probable that two specimens which I have in my collection under E. *bicaudata*, Moore, having the whole area on the forewing beyond the postmedial line dark brown, may be referable to this. The specimens are, however, in not sufficiently good condition to determine.

Genus DIRADES, Wlk.

3064. *D. unicauda*, Hmpsn.

Sikhim and Bhutan, 1,800—3,000 feet. Taken at light in July, August and September. The male has the neuration of the hindwing much aborted.

3064*a*. *D. lituralis*, Warr.

Sikhim, 1,800 feet. I took one specimen of this at Punkabaree attracted to light in March. It is probably rare, as I have not seen another.

3065. *D. theclata*, Guen.

Sikhim and Bhutan, 1,800—3,000 feet. Occurs with *D. unicauda*, Hmpsn., at light and is rather more plentiful.

Genus GATHYNIA, Wlk.

3070. *G. miraria*, Wlk.

Sikhim, 1,800 feet. I have eight specimens taken by me chiefly at light at Punkabaree in the cold-weather months. It reposes with the wings rolled up tightly into elongate cylinders and spread in the form of a cross. My specimens were taken in January, February, March, June, October and December. I never procured this in Bhutan. (This must be local as I never saw more than one specimen in Möller's collection.—*H. J. E.*)

Genus METORTHOCHILUS, Hmpsn.

3074. *M. emarginatum*, Hmpsn.

Bhutan, 2,500 feet. I took two specimens—a pair—at light at Fagoo in May, but have never seen a Sikhim specimen. (I never saw a Sikhim specimen and know it only from the Naga and Khasia Hills.—*H. J. E.*)

THE ANOPHELES OF KARWAR (NORTH KANARA).

(With a Plate.)

BY H. COGILL, M.R.C.S., L.R.C.P.,
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Of the known species of *Anopheles* occurring in India the following were found by the author :—

1. *A. fluviatilis*, James.
2. *A. culicifacies*, Giles.
3. *A. Jeyporensis*, James.
4. *A. Jamesi*, Theobald.
5. *A. nigerrimus*, Giles.
6. *A. barbirostris*, van der Wulp.
7. *A. Rossi*, Giles.

In addition to these, five species, new to India, have been discovered. Two of these were first found by Mr. E. H. Aitken, and have been named *A. Aitkeni* and *A. Karwari* by Theobald. Two others have been identified by the same authority as *A. leucophyrus*, Donitz, var. *A. elegans*, and *A. punctulatus*, Donitz. The identity of the fifth species has only recently been definitely settled, as the imago very closely resembles *A. Aitkeni*. The isolation of the larvæ has finally established them as separate species, and the last has been provisionally named *A. culiciformis*.

Of the known species *A. fluviatilis*, James, was noted as very common at certain seasons. It was found from April to February (the period over which these observations extended). It first became really plentiful during the early rains towards the latter end of May and in June ; during the heavy rains in July to September it was scarce ; from October to January it was extremely abundant again.

It is of interest to note that the *malarial incident*, as observed in cases treated at the Civil Hospital, Karwar, showed a marked rise during May, June and July ; from then to the end of October a very low rate ; and during November, December and January the maximum rate was reached.

The larva of this species was found in all forms of slowly moving waters including rice fields. The distinctive features of the larva are too well known to need description ; it may be noted, however, that the frontal bristles are by no means constant in character, as one or more fine filaments are not uncommonly found on the median bristle.

A. culicifacies, Giles, was very rare and the larva was not isolated.

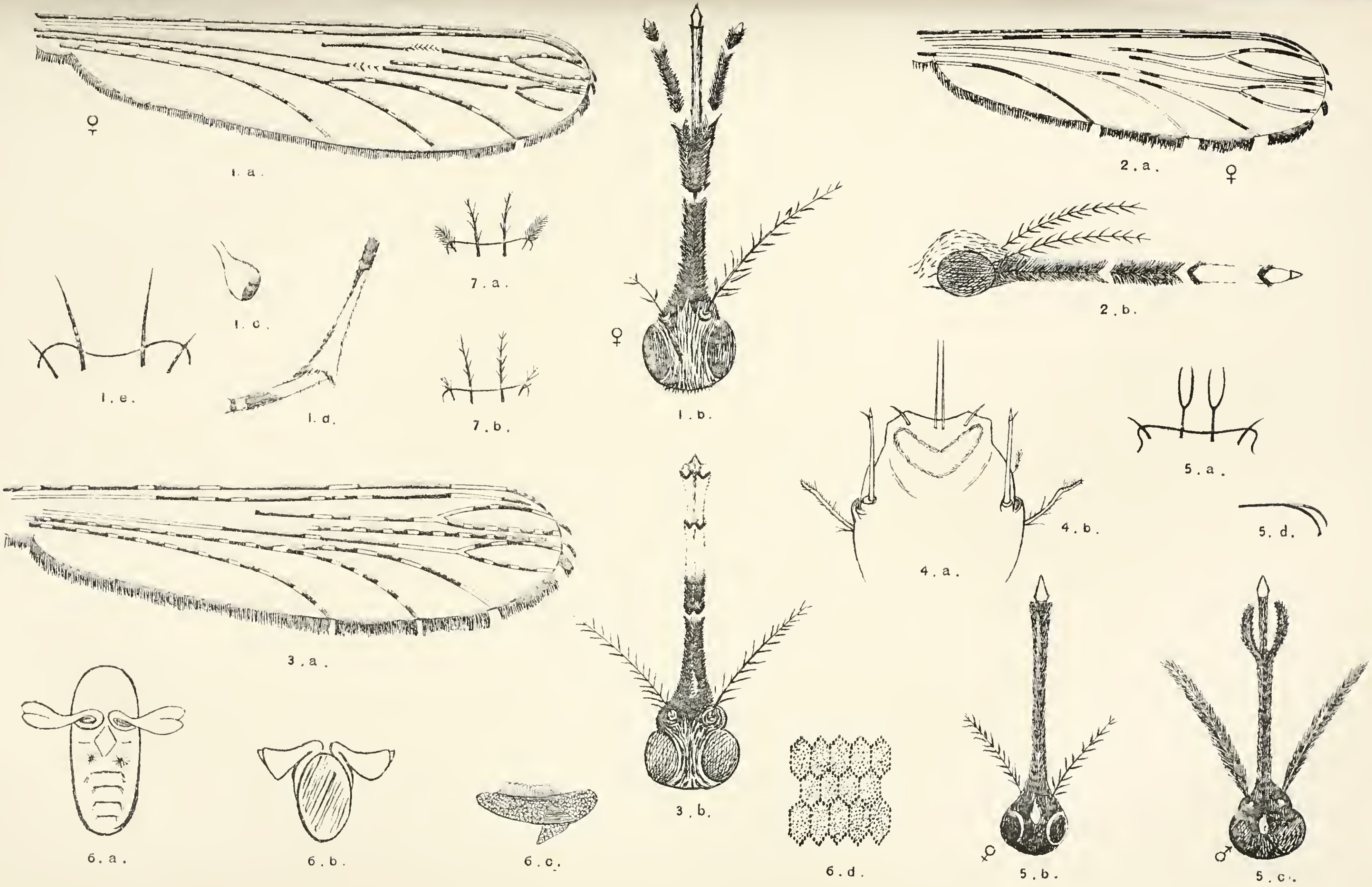
A. Jeyporensis, James, was also very rare, and only two larvæ were isolated.

A. Jamesi, Theobald, was one of the most constant, the larva being found in all forms of clean natural waters. The mature insect does not exactly correspond with any of the allied species described by James in his "Malaria in India," but the larva is identical; and it would therefore appear that the gnat bred is another variation of *A. Jamesi.*

It has been noted that the larvæ of this species mounted in formalin show very marked variations with regard to their frontal bristles. These variations were so striking as to make it appear at first that separate species were being dealt with; but the examination of a large number of imagines showed no variation. The extreme variation in the bristles are shewn in figs. 7a and 7b of plate. Many living larvæ were examined, and the bristles in all cases were found to be true to type; these larvæ were then mounted in formalin and the variations again appeared. It became evident that the variations were mechanical and were probably due to the fine filaments making up the branches of the bristles becoming adherent to the parent stem, and thereby causing an apparent difference in character. It is, therefore, important, in larvæ with bristles of this description, to examine living specimens to make absolutely sure of their true nature.

A. nigerrimus, Giles, is generally described as a wild species. In Karwar, at certain periods of the year, as, for example, at the end of the rains, it was the only common *Anopheles* found in houses. It first made its appearance in early September, and for two months afterwards large numbers were captured. In all cases eggs were easily obtained, when required, in captivity. It was not until October that the larva was first discovered; but, from then up to the end of the year, it was extremely common in all forms of clean waters, especially in rice fields. On one occasion its larvæ were found together with those of *A. Rossi* in a muddy road-side puddle.

The egg of this species and of *A. barbirostris* has an enveloping membrane of extremely beautiful structure. This membrane embraces the egg and closely resembles a net in appearance; it is of the simplest structure, consisting of a single layer of very regular, hexagonal cells with dotted outline and granular matrix. It is very friable. Towards


♀
1. a.
1. b.
♀
1. c.
1. d.
1. e.
2. a.
♀
2. b.
3. a.
3. b.
4. a.
4. b.
5. a.
5. b.
♀
5. c.
♂
5. d.
6. a.
6. b.
6. c.
6. d.
7. a.
7. b.

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the concave margin the membrane becomes expanded, forming a crinoline-like structure ; and in this expanded portion it does not show the cellular structure described above, but is made up of fibrous rib-like processes running to the free margin. The free margin is coarsely toothed (*vide* Plate, figs. 6c and 6d).

The pupa of this species and of *A. barbirostris* shows striking differences from the pupæ of all other forms hitherto examined. The most marked difference lies in the "breathing-horns": the tube, before expansion, arches up over the dorsum of the thorax almost meeting that of the opposite side in the mid-line, and is then bent back on itself at right angles to the dorso-ventral plane of the pupa, thereby becoming inverted U-shaped ; it then expands into a cavity somewhat resembling in shape an open mussel-shell, the free margin being split centrally, the cleft running well into the cavity so as to increase the abovementioned resemblance. The cavity extends back into the U-shaped stem (*vide* Plate, figs. 6a and 6b). The structure and shape of the "horns" can only be made out by examining pupæ in the recent state as, in preserved specimens, it is impossible to fix the pupa in such a position as to examine it from above. In all mounted specimens in the author's collection the "horns" are seen to be more or less collapsed. It is more than probable that these species can completely close up the cavity of the "horn" when necessary.

In addition to this difference in "horns," the hairs on the segmental margins are in many cases compound and always of a very dark colour. It would appear that this marked divergence from the usual type should place these species in a separate genus.

A. barbirostris, van der Wulp, was found breeding in the same type of water as the preceding, and at the same season. The imago was only found in houses on two or three occasions. The larva was very common. The characters of the pupa have been described above. The males of this species show a constant variation from those described by Giles, and others under the same name, in the palpi always having a narrow but well marked band of white scales at the apex of the first segment, as well as two patches of white scales on the bulb, one near the apex, and the other at the base.

A. Rossi, Giles, was always found to be abundant. The enveloping membrane of the egg of this species does not show nearly so regular a structure with regard to the cells as those of *A. nigerrimus* and *A. barbirostris*.

Of the species new to India

A. leucophyrus, Donitz, var. *elegans*, Theobald,

was first discovered in April in a jungle spring together with *A. culikiformis*, sp. n., and *A. fluviatilis*, James. Only two larvæ were obtained then, and it was not found again until the cessation of the rains when it became very abundant. Whilst water was plentiful it was found in the open, but as a rule it was found in jungle springs and was particularly partial to waters containing decaying leaves. (For sketches *vide* Plate, fig. 1a to fig. 1e.)

Larva.

The larva is, as a rule, of a rich brown colour, with the palmate hairs very pronounced, and commonly visible to the naked eye. It is not uncommonly seen hanging perpendicularly to the surface of the water, in the attitude ascribed to *A. Turkudi*. It thrives best in water containing plenty of mould. It closely resembles that of *A. Rossi* in character.

Frontal bristles, median : very long, far apart, simple.

Frontal bristles, angular : short, simple.

Palmate hairs : on the 3rd to 7th abdominal segments, that on the 7th segment not so well developed as the rest ; an extremely ill-developed palmate can also be made out on the 2nd segment, but is not constant. The individual hairs are broad, and narrow rather suddenly at the extremity where there is a spine of moderate length.

Imago.

The imago shows very striking differences from *A. leucophyrus*, Donitz, as described in Giles ; in fact, beyond similarity in wing markings and position of transverse veins there is no resemblance. A description is therefore given in detail. The characteristics are : (1) a large ferruginous anal tuft ; (2) palpi with four narrow white bands ; (3) halteres covered with white scales on knob with a black patch in centre ; (4) a very broad white band on the tibio-tarsal articulation of the hind leg ; and (5) most elaborate ringing and maculation of all legs.

Palpi : in the female, black with white tips and with narrow white bands at the next three articulations ; in the male with large clubs mostly white, but with narrow black band at middle and base ; in the male there are also two additional white bands on the club, one at the middle and one near the base as well as many white scales on the basal half.

Proboscis : in the female black, with a marked yellow tip, slightly longer than palpi ; in male the marking is the same, but it is shorter than palpi.

Antennæ : with a ring of white scales at the base, and a tuft of white scales at the apex of first segment, and many white scales on the rest of same segment.

Head : with a well marked crest composed of white scales, and long white hairs. The forked scales are all black.

Thorax : slate-grey, with many short, white, hair-like scales on the dorsum. There are fairly well marked dorsal and dorso-lateral lines of a dark colour, and two irregular-shaped black spots laterally in the wing-plane.

Pleuræ : with dull white decoration.

Halteres : white-scaled, with a patch of black scales on the centre of knob.

Abdomen : slate coloured, bare, with only a few slender, curved hairs.

Legs : yellowish white articular bands on all tarsal joints, most marked on the fore-legs and hind-legs. On the tilio-tarsal joint of the hind-legs there is a very broad yellowish white band, 1/8 of the first tarsal joint, and 1/5 of the tibia participating. The tibio-femoral articulation of the leg is white. All legs, with the exception of their 3rd, 4th and 5th tarsal joints, are most elaborately ringed and speckled with yellowish white scales. The tibia of the fore-leg has a narrow apical white band. Coxæ of all legs with many white tufts.

Wing : of the male is much lighter coloured than the female, especially towards the inner margin, the paleness being due to the markings being much less pronounced. In both sexes the 2nd transverse vein is slightly external to the 3rd, and the 4th is much internal to both. The wing fringe is black for the most part, and is light coloured at the apex; there are small light interruptions at the 2nd, 3rd, 4th (both branches) and at the outer branch of 5th longitudinals.

Length : 7 mm. including proboscis which is 2 mm.

A. punctulatus, Donitz, is only mentioned by Giles in his second edition of "Gnats and Mosquitoes" on pp. 287.

The only specimens obtained were females caught in the bungalow during the heavy rains from July to October. The imago very closely resembles *A. leucophyrus*, var. *A. elegans*, but it differs from that species in the markings on the palpi, and in not having the broad white band on the tibio-tarsal articulations of the hind leg. (For sketches, *vide* Plate, figs. 3a and 3b.)

Palpi: in the female the whole of the apical 2/5 of the palpus is smoky white, except for two very narrow black bands which divide it into three. One of these black bands is situated near the apex, and the other at the next joint. The remainder of the palpus is black, except for a narrow white band at the base of the 2nd joint. There are thus two narrow and two broad bands of each colour. There is also a tuft of white scales on the centre of the basal segment.

Antennæ : have a tuft of white scales on their basal joints.

Head : has a well marked silver-white crest composed of short scales and long hairs. The forked scales are black.

Thorax: slate-grey, covered with light coloured hairs. There are ill-defined dorsal and dorso-lateral lines of a darker colour ; and in the wing-plane are two black dots ; there is also a black dot or spot on the scutellum. Along the anterior margin of the thorax there are three tufts of long white scales.

Pleuræ: much decorated with silver-white patches.

Halteres: covered with white scales.

Abdomen: black with many light-coloured, evenly distributed hairs.

Wings: with the 2nd transverse vein opposite the 3rd, the 4th more than its own length internal. The fringe is creamy white at the apex of wings and at the junctions of the longitudinals: otherwise it is black.

Legs: light coloured at articulations, mottled and ringed. Coxæ with many large white tufts.

Of the new species

A. Aitkeni, Theobald.

This is a "clear" winged species. It was first found by Mr. E. H. Aitken on the Goa frontier. A few isolated specimens were bred from May onwards. It was not until December that its larva was isolated. Larvæ were only found in pools situated in thick "evergreen" jungle.

Larva

is small, compact, and of a brick-red colour, is 3 mm. in length and very closely resembles *A. fluviatilis* larva except that, unlike the latter, it prefers living in the deeper water in the centre of the breeding vessel. Bristles of larva are figured in Plate, figs. 5a and 5d.

Frontal bristles, median : thick and bifurcated at extremity, the ends curve downwards, forming a regular pitchfork.

Frontal bristles, angular: short, simple.

Buccal hair : covered with long, simple branches, true to usual type.

Palmate hairs : are on segments 2 to 7. On the posterior portion of the thorax and on the first abdominal segment there is a hair in no way resembling a palmate in structure, but apparently performing the same function. A similar condition is found in *A. Jamesi.* James, in his "Malaria in India," calls them palmates.

3rd balancer : true to type.

Pupa

has the "breathing horns" of the usual type and widely separated at the base.

Imago.

The resemblance of this species to a culex is astonishing; it is very small, has "clear" wings, and habitually settles in the attitude attributed to a typical *Culex.* To add to the resemblance the abdominal segments are of a lighter colour at their junctions, and give an appearance of banding.

Palpi : black, those of the male much clubbed.

Proboscis : black in the female and considerably longer than the palpi; that of the male is even longer in proportion.

Head : black, with a few white scales forming a small crest; all the forked scales are black, and are scanty in number.

Thorax : light brown, nude, with only a few slender black hairs on dorsum.

Halteres : fuscous, with black knobs.

Wings : with all the nervures black-scaled; the scales small. Transverse veins are alternate, 2nd opposite 4th, 3rd external. Fringe is black.

Abdomen : nude, except for a few black hairs. Segment margins are lighter than the rest, and there is a brown dorsal line on the 1st, 3rd or 4th segments of abdomen.

Legs : black; claws true to type.

A. culiciformis, sp. n.

This is also a "clear" winged species. It was one of the first Anopheles bred in Karwar, but for long it was confused with *A. Aitkeni.* Only isolated specimens were to be found until the latter end of the rains, when it became abundant. The larvæ were, as a rule, found in jungle pools. On one occasion a large number were found breeding in water contained in a small hole in a tree-trunk. They continued to be fairly plentiful up to the end of October.

Although it is only by the closest examination that the imagines of these two "clear" winged species can be differentiated, a study of their life history shews them to be very distinct species. The great difference between them will become evident when the larval descriptions are compared, and it is probable that, when all species of Anopheles are properly classified, the two will not be even in the same genus.

The larva of this species differs much from those of any of the other species examined. It shows variation in structure in two appendages which are constant in all other forms. The first of these appendages is a bristle situated near the margin of the buccal cavity almost in the same plane as the antennæ, but just inferior to it : this bristle has, for convenience of description, been named the " buccal bristle." The second appendage is the " balancer " situated on the 3rd abdominal segment.

Larva.

Frontal bristles, median : long, very close together, and unbranched as far as can be made out ; *angular*, short, simple.

Buccal bristle : is almost devoid of branches up to the extremity, where it is expanded into a marked enlargement which is almost flat antero-internally and convex postero-externally, having a corona of hairs round the flat margin. At the origin of the bristle on the thorax there is a plain stiff hair (*vide* figs. 4a and 4b).

Palmate hairs : situated on the 2nd to the 7th segments.

3rd abdominal balancer : is single as in other species, but instead of being branched throughout its length, is quite plain.

Imago.

Palpi : black, rather slender.

Proboscis : black, slightly longer than palpi.

Antennæ : plain black.

Head : black, with a small crest of white scales.

Thorax : dull chocolate-brown with dorsal and sub-dorsal lines of a darker colour.

Halteres : fuscous.

Wings : black scales throughout ; the 2nd transverse vein opposite the 3rd, the 4th internal.

Legs : the claws of the male fore-legs differ from all the other species in that they have not the short thumb-like second claw characteristic of the remaining species.

Abdomen : dark chocolate coloured, plain.

Length : 4 mm. without the proboscis which is 2 mm.

A. Karwari, Theobald,

was first found by Mr. E. H. Aitken in April ; it was very common in May and continued abundant throughout the rains to the end of the year. Unfortunately, when larvæ were required for description and preservation, none were to be found. The larva was found in all sorts of clean waters and was the commonest Anopheles in Karwar. For sketches *vide* Plate, figs. 2a and 2b.

Imago is chiefly characterised by long white tips to the palpi, light coloured wings, and by the last two and a quarter joints of the tarsi of the hind legs being all white except for a broad black band on the middle of the 4th tarsal joint.

Palpi: with long white tips comprising the two apical joints divided into two by a narrow black band on the apical joint; there being beside two narrow white bands at the apex of the 1st and 2nd segments, the distal white band being separated from the long white area by another black band (fig. 2b). There are thus two broad black bands and two broad white bands as well as two narrow black bands and two narrow white bands. In the male the white areas of the palpus do not form complete bands.

Proboscis: black; same length as palpi.

Antennæ: slender, with silver-grey hairs.

Head: with a very well marked crest of silver-grey hairs and scales of the same colour.

Thorax: dark, covered with silver-grey hairs dorsally. There are slightly marked dorsal and dorso-lateral lines of a darker colour. On either side of the mid-line there is a black spot.

Pleuræ: decorated with silver-grey hairs.

Halteres: black-knobbed, with fuscous stems.

Abdomen: dark brown with light brown hairs on the segmental margins; a sub-lateral white spot on segments 2 and 4.

Wing: transverse vein 2 is slightly external to 3, 4 is much internal to both.

Legs: last two and quarter tarsal joints of the hind-leg white, except for a broad black band on the middle of the 4th joint. All other articulations light coloured, most marked in the hind legs. There is no sign of maculation. The claws are normal.

DESCRIPTION OF PLATE.

1. *An. leucophyrus* (Donitz) var *elegans*. 1a wing of ♀, 1b palpi of, 1c halter of, 1d tibio-tarsal articulation of, 1e frontal bristles of.
2. *An. Karwari* (Theobald). 2a wing of ♀, 2b palpi of.
3. *A. punctulatus* (Donitz). 3a wing of ♀, 3b palpi of.
4. *A culiciformis*. Head of larva of, showing " Buccal bristle " 4b.
5. *A. Aitkeni* (Theobald). 5a frontal bristle of, 5d same in contour, 5b and 5c palpi of ♀ and ♂.
6. *A. nigerrimus*. (Giles). 6a pupa of, 6b same with "breathing horns " in contour, 6c egg of, 6d enveloping membrane of egg × 450.
7. *A. Jamesi*. (Theobald), showing extremes of variations in Frontal bristles.

THE BIRDS OF THE MADHUBANI SUB-DIVISION OF THE DARBHANGA DISTRICT, TIRHUT, WITH NOTES ON SPECIES NOTICED ELSEWHERE IN THE DISTRICT.

By C. M. Inglis.

Part VII.

(Continued from page 77, No. 1, Vol. XV.)

Order—ANSERES.

Family *Anatidæ*.

Sub-family *Anserinæ*.

(298) Anser ferus.—The Grey Lag Goose.

Blnford, No. 1579 ; *Hume*, No. 945.

The first specimen of this goose I got was snared near Jhanjiarpur on the 4th of April this year. On the 25th of May I received a second one snared on the Hurrietta Chaur. These are the only two I ever got in the district. Both dates are exceptionally late for them to be found in the plains; the latest date recorded being the 2nd of May when two were received by Colonel Unwin in Cashmere. Native name *Hans, battak.*

(299) A. indicus.—The Barred-headed Goose.

Blanford, No. 1583 ; *Hume*, No. 949.

Geese are not common anywhere in the district. I believe they are fairly plentiful on the Ganges in the cold weather. They commence to arrive here in October, some remain sometimes till June. I have never seen them so late, but Mr. G. Dalgliesh mentions so in the *Zoologist* and Mr. Miller told me he saw a couple on the river near Russulpore during that month. My experience of this bird in captivity is the same as Finn's, having found it to keep in the pink of condition during the summer. I have one here which I have now had over three years. A few geese are snared every year on the Kamla River, seldom this side of the frontier, but usually in Nepal. They are snared in nets stretched across the sandbanks. The fishermen who snare them in Nepal call them *Ghango*. Native names *Hans* and *Battak.*

Sub-family *Anatinæ*.

(300) Sarcidiornis melanonotus.—The Comb Duck or Nukta.

Blanford, No. 1584 ; *Hume*, No. 950.

Near Jainagar a pair flew past me in July 1898. The male had a knob on the bill and there was no mistaking the species. On the 20th April, 1902, a male was brought me by a mirshikar, and on the 8th January of this year I got a female snared on the Maiser Chaur, not far from Bunhar Factory. This duck is very rare in the district, the only other record I can find of its occurrence here being in the *Zoologist*, recorded by Mr. G. Dalgliesh, who says: "A small flock was seen by my brother at Dalsing Serai in May 1899, out of which a male was shot." Native name *Nukta.*

(301) Rhodonessa caryophyllacea.—The Pink-headed Duck.

Blanford, No. 1586 ; *Hume*, No. 960.

I have never come across this species, but the mirshikar, who used to bring me duck and teal from Minti, described a bird which had been snared there which was evidently this species. Blanford gives it as fairly common in Tirhut, but I think this must be a mistake, as Mr. Edgell, who has done a lot of shooting both in this district and in Monghyr, has never come across it. Mr. Baker says it has been obtained at Mozufferpur.

On the 9th August of this year a fine male pink-headed duck was brought to me by a mirshikar from Benoa Chaur. There were two of them he said, but he was only able to snare one. This one I kept in my aviary for some time with a pair of mandarins, but it did not thrive, so I killed it. These are the colours of the soft parts :—*Bill*, light pink, pinker at tip on tail ; base of maxilla and whole lower mandible flesh colour, this colour being on some skin ½″ broad at the base of the maxilla ; edge of nostrils black ; *iris*, bright red ; *legs and feet*, reddish black ; rim round eyelids flesh colour. Nobody seems to have noticed the most conspicuously black edge to the nostrils.

(302) TADORNA CORNUTA.—The Sheldrake.

Blanford, No. 1587 ; *Hume*, No. 956.

Very rare. I have only received two specimens from this district. The first was received from Mr. Edgell, who shot it on the Suwasingpore Chaur near Shapooroondie about Christmas time, and the second was snared by a mirshikar on the 11th May of this year. This is exceedingly late for this species to be found in India. There was another sheldrake on the Chaur, but the mirshikar could not snare it. Mr. Edgell once saw three on the Baraila Chaur. Native names *Shah-chukwa* and *Safaid surkhab.*

(303) CASARCA RUTILA.—The Ruddy Sheldrake or Brahminy Duck.

Blanford, No. 1588 ; *Hume*, No. 954.

Very common during the cold weather. They arrive in October and remain here till the end of April. I have recorded in this Journal the change of plumage after undergoing a moult from pale buff to deep orange brown. I found traces of the black collar in a male shot on the 19th January and the complete collar on one shot on the 4th February. In February 1899, I came across about 200 feeding in the paddy lands near Jainagar. They were mostly feeding in pairs and, on being scared, flew off, keeping in pairs. They were quite a mile from any water. I also counted 26 pairs on the banks of the Kamla near Oosrahi, each pair was only a couple of yards apart. These birds were very wary, but others at Muriah Ghât on the same river were comparatively tame, and one could generally depend on bagging one were there any about. Here they are to be found all over the country, on rivers, on old river beds in which there is water, and also on large and small marshes. Native names *Chukwa, Chukwi* and *Surkhab.*

(304) DENDROCYCNA JAVANICA.—The Whistling Teal.

Blanford, No. 1589 ; *Hume*, No. 952.

Exceedingly common. Towards the end of May they start going about in pairs' arranging about nesting sites. They commence to lay towards the middle of July. I took a nest on the 31st August with ten fresh eggs. Like Mr. Baker I consider eight or ten the normal number of eggs. I once found a nest on the ground in some grass not far from the water edge, all others have been either on trees or bamboos. Description of nestling in down is: A spot at base of both wings and on each side of rump, also a broad supercilium and a broad band from gape above dark triangular spot and right round nape, chin, throat and sides of neck and whole lower plumage greyish and white with base of down and tips of hairs brownish; remaining plumage blackish brown. *Bill*: Upper mandible plumbeous, with the margins and whole of lower mandible yellowish, except tip of the latter which is pale, and the nail of the former is dark flesh colour; *iris*, brown; *legs* and *feet*, black; *claws*, brownish, horny. An albino of this species was seen by Mr. A. Christian at Umgaon. Native name *Silhi*.

(305) D. FULVA.—The Large Whistling Teal.

Blanford, No. 1590; *Hume*, No. 953.

Mr. Christian told me that a bird of this species used to visit his tank at Umgaon. I think he must have been mistaken, as I have never found it in the district, nor do the mirshikars, to whom I have shown a specimen, know the bird. Of course it may occur and might be overlooked.

(306) NETTOPUS COROMANDELIANUS.—The Cotton Teal.

Blanford, No. 1591; *Hume*, No. 951.

Common. I have seldom found their nests, and have been most unsuccessful about getting eggs, not having a single one. On the 17th July 1899, I got a nest with one egg, which was left: it was revisited on the 28th and found to contain two broken eggs and was deserted. Another nest had also one egg which was also left, but had disappeared on being examined later. Native name *Girra*.

(307) ANAS BOSCAS.—The Mallard.

Blanford, No. 1592; *Hume*, No. 958.

Very rare. A female was brought me on the 15th November 1899, from Minti Chaur. Mr. Scroope and Mr. Onrait shot one at Khatauna on the 2nd February, 1900. Mr. G. Dalgliesh, in the *Zoologist* and says:—"A pair were shot out of two pairs on Hattowrie Lake in December 1897, and I saw a solitary female at Dalsing Serai in January, 1900. Mr. Edgell has shot one or two.

(308) A. PŒCILORHYNCHA.—The Spotted-billed Duck.

Blanford, No. 1593; *Hume*, No. 959.

The only specimen I have is a female which was presented to me by the late Mr. "Peter" Grahame, who shot it on a chaur near Ramnugger Factory on the 24th June, 1900. There was another which he says he could have shot if he had not been so busy keeping his dog from getting the one he shot. Mr. G. Dalgliesh mentions in the *Zoologist* that he saw a pair at Dalsing Serai in June, 1901.

(309) EUNETTA FALCATA.—The Crested or Falcated Teal.

Blanford, No. 1594; *Hume*, No. 966 *bis*.

I have nothing further to add to my notes on this species already published in this Journal. I have not seen any specimens since the cold weather of 1900, though a good number of duck and teal have passed through my hands since then. I have also had men on the look out for any rare species on the different marshes, but none of this species have been got. I fancy there must have been an influx of this species from 1898 to 1900.

(310) Chaulelasmus streperus.—The Gadwall.
Blanford, No. 1595 ; *Hume,* No. 961.

Exceedingly common every year. The earliest notice I have of their arrival is on the 19th August. They leave by the middle of March. I once wounded a gadwall and a red-crested pochard and found the gadwall kept under water much longer than the pochard, and always made for the shallow water near the bank, where it lay on the surface with its head and neck *under* water as if it was dead ; but no sooner did any one attempt to get at it, or even when a gun was fired, it dived and swam a considerable distance under water. I spent over an hour retrieving it. Native name *Mail.*

(311) Nettium crecca.—The Common Teal.
Blanford, No. 1597 ; *Hume,* No. 964.

Very common. I have not found it as common as the garganey, but Scroope found it commoner than that species in the south and west of the sub-division. They arrive about the end of September and leave in April. I have seen them packed together on the Kamla like *Q. circia.* On one or two occasions I have found them tame and confiding even after being shot at. Native names *Lohti* and *Murghábi.*

(312) Mareca penelope.—The Wigeon.
Blanford, No. 1599 ; *Hume,* No. 963.

This species is rather scarce. The earliest date I have of its arrival is the 31st October. They leave, I think, by the end of March. I have found them do well in a tealery. Native names *Chowma* and *Basillia Chowkee.*

(313) Dafila acuta.—The Pintail.
Blanford, No. 1600 ; *Hume,* No. 962.

Very common. The earliest record I have of their arrival here is the 30th September. They leave about the middle of March; a few remain till the end of the month. This species and the gadwall are the commonest ducks found here. This is the best duck we have for the table. A male I had in my tealery only started to change into undress garb on the 21st August. Native name *Dighans.*

(314) Querquedula circia.—The Garganey or Blue-winged Teal.
Blanford, No. 1601 ; *Hume,* No. 965.

Abundant. The earliest date I have of their arrival is the 25th of August, when I saw about half a dozen flying overhead near Jainagar. They leave here usually about May, but I have seen some in June. Native names *Gairi* and *Adni.*

(A pair were seen on the Maiser chaur on the 6th August this year and was secured.)

(315) Spatula clypeata.—The Shoveller.
Blanford, No. 1602 ; *Hume,* No. 957.

Fairly common. They arrive early in November and leave about the end of March. Native name *Sukchúr.*

(316) Marmaronetta angustirostris.—The Marbled Duck.
Blandford, No. 1603 ; *Hume,* 961 *bis.*

I have no authentic record of this species having been found in the district, but my man fired two shots at a teal on the 10th February, 1901, which he said was new to my collection, and from his description of the bird the only conclusion I could come to was that it was this species.

(317) Netta rufina.—The Red-crested Pochard.

Blanford, No. 1604; *Hume*, No. 967.

Common. They arrive in October and most have left by April. On the 20th May, 1900, I got a male of this species as already recorded in this Journal. The Pochard I wounded at the same time as the gadwall never came near the land but swam and dived in the middle of the river; when swimming below the surface of the water it was always visible from the bank. It had a beautiful pale rosy tinge on the white of the flanks, axillaries and under wing-coverts. I have found the flesh of this species slightly rank and even the best, in my estimation, never comes up to either the pintail or gadwall. However, I have heard some people here say they preferred it to any of the ducks. Chacun a son gout. A solitary male came to a small shallow patch of water, only knee-deep, quite close to the Factory at Narhar, where my tame ducks were feeding. It was very tame, taking no notice of the numerous people who came from and went to the hât, which was held close by. On being wounded it made no attempt to dive but swam towards the shore. Mr. Scroope wrote me that he saw numbers of ducks migrating at the end of March. Some were flying very high and others low down: they appeared like clouds all flying north in Vshaped formation. He says it took a good five minutes passing over. The lower flocks appeared to be *N. rufina*. Native name *Lalsir*.

(318) Nyroca ferina.—The Pochard or Dun-bird.

Blanford, No. 1605; *Hume*, No. 968.

I found this duck very rare in the sub-division, only getting a couple of females there. Mr. Scroope told me he had seen two male pochards on the 17th December, 1899, in a tank at Katai, south of Marthou on the Mynathpur-Basopati road. The tank was an old one partly silted up and surrounded by *surput* grass. They were very tame. Scroope rose them up and they flew off but came back again. A number of white-eye were in the same tank. They do not appear to be so scarce in the Maiser Chaur not far from Kurrian. I have received some eight or nine pairs. I do not think they reach us earlier than the beginning of November. I got a male on the 3rd of that month, and they leave in March. Mr. G. Dalgliesh got a male in female garb on the 9th July. Native name *Lalsir*, *Cheun*.

(319) N. ferruginea.—The White-eyed Duck.

Blanford, No. 1606; *Hume*, No. 969.

Very common. They arrive in September and leave in April. They appear to be commoner in tanks than in the chaurs. I got a female with a few white feathers forming a spot on the foreneck and this specimen had also a very *large* white spot on the chin. I have recorded in this Journal the colour of the irides in the female of this species. These duck are preferred by many people here to the better class water fowl, and I must say I have often found them very decent eating. Native names *Dumár*, *Chotá májeeta*.

(320) N. BAERI.—The Eastern White-eyed Duck.
Blanford, No. 1607.

I have never come across this species, but think it is most likely to occur on some of the large marshes in the district.

(321) N. FULIGULA.—The Tufted Duck.
Blanford, No. 1609 ; *Hume*, No. 971.

This species is rather scarce. They arrive at the end of October and leave in March. Usually they are found in the large chaurs, but I once got a pair on quite a small tank. I have a male with a fairly large white spot on the throat. Native names *Malka, Majeeta.*

Sub-family *Merginæ.*

(322) MERGUS ALBELLUS.—The Smew.
Blanford, No. 1612 ; *Hume*, No. 973.

One of my men saw a bird on the Chilwara Jheel on the 12th February, 1901, which, from his description, I think was a Smew. I also am certain I saw one about the same time on another large jheel, but I could not get a shot at it.

(323) MERGANSER CASTOR.—The Goosander.
Blanford, No. 1613 ; *Hume*, No. 972.

Mr. Scroope wrote to me on the 21st March, 1899, "At Kachara there are many duck. . . . . . . I could make out were a few shovellers and four *goosanders*." He was certain that he identified them all right, as he says: "Their snakey appearance on the wing and black head render a mistake as to the species impossible." Mr. Edgell kindly presented me with a skin of this species which he shot on the Suwasingpur Chaur.

ORDER—PYGOPODES.

Family *Podicipedidæ.*

(324) PODICIPES CRISTATUS.—The Great-crested Grebe.
Blanford, No 1516 ; *Hume*, No. 974.

Scarce. Mr. Scroope saw some near Jhanjiarpur at the end of November. I got two on the Ootidee Chaur on the 15th February, 1901, and 1st December, 1902, and Mr. Maddox shot one on the 8th January, 1903. He sent it to Mr. Miller of Hatauri Factory who kindly gave it to me. Mr. G. Dalgliesh got one at Dalsing Serai on the 2nd December, 1900, and saw two others. All the specimens I have got are males. I saw a pair on the Ootidee Chaur on the 22nd December, 1900. They were in very deep water and kept to it. Unfortunately I had no boat, and they were rather far off. I fired six shots at them in the hope of getting one, but was not successful. The last shot fired was No. A and it made them fly, they only dived at the other shots. After getting on way they flew pretty high up off the water and travelled with greater speed than I expected. In 1901 more were seen than usual, the last was noticed on the 9th March. In 1902 a single one was got and it was brought in alive by a mirshikar, and this year none were seen by any of my men.

(325) P. NIGRICOLLIS.—The Eared Grebe.
Blanford, No. 1616 ; *Hume*, No. 974 *bis.*

I have no note of the occurrence of this species in the district, but Mr. G. Dalgliesh writes to the *Zoologist*: "In December, 1897. . . . . . I saw a grebe, which I am nearly certain was this species, but not collecting birds at the time and not wishing to frighten the duck by firing I did not shoot it. Since then I have examined specimens of the eared grebe, and they exactly resemble the bird I saw."

(326) P. ALBIPENNIS.—The Indian Little Grebe or Dabchick.

Blanford, No. 1617 ; *Hume*, No. 975.

Abundant everywhere. They breed here from the beginning of July and well into August. These little birds are most interesting to watch, and if not molested get comparatively tame. There were a pair in the Indian Museum pond who were on quite friendly terms with Mr. Finn. I have got several birds in February still in summer plumage. Native names *Pandubi, Lokri.*

MISCELLANEOUS NOTES.

No. I.—LATE STAY OF SNIPE.

It seems to me exceptionally late for snipe to stay so far south as this in April, but on the 7th April I saw 12 snipe in the rice fields here and shot three. On the 12th I saw seven and shot one, and on the 20th I flushed one from under a bush, and though I searched high and low for its nest I was not successful in finding it.

I am informed that it is not unheard of for snipe to stay all the year through in Kanara, but I do not know if this is so.

C. D. LESTER, Captain.

Camp Anmod, Castle Rock, N. Kanara,
26th April, 1903.

[This note raises an interesting point which it is hoped our members will continue to develope, namely, the dates of arrival and departure each year of the migratory birds—not only the migratory game birds which go to Central Asia and Siberia for breeding purposes, but all birds which migrate in this country, even from the plains to the hills, and other local migrations.—Ed.]

No. II.—A PANTHER EXPERIENCE.

There had been many people eaten by panthers in the taluka during the past monsoon. The grass was high everywhere, and the cultivated fields were little better than weed-gardens ; the houses of the villagers were amongst the fields, separated one from the other by, generally a hundred yards or so, and made of grass as to walls, roof and door. A panther would come along, sneaking quietly up to a house in the darkness of the night, listen (I presume) for a sleeping person in a convenient position on the floor inside, make a parting in the grass wall, seize the individual by the throat, and be off into the high, dense grass before any one was well awake ; sometimes, I believe, no one did wake. A boy was carried off from amongst three men, all four watching a field, from a threshing floor (a circular cleared bit of ground, generally at the side of the field near or under a large tree in this part of the world). The panther came first at dusk : the men saw it put its head out of the grass close by : they of course shouted and the panther disappeared. After they were all asleep, however, it came back, sneaked up, seized the boy by the throat (the men say, there was no noise or cry), and went off with him to a distance of a quarter of a mile or so, where it ate half of him, and was traced next morning by the three men through the grass ; but of course there was no panther when they got there ; only the gruesome remains of the boy. In seven cases of such deaths there was not a single beast brought to book. Sometimes men sleep in platforms in trees, though I have not heard of any one being taken out of such a place by a panther. This is a prelude to my story.

I had been tying up goats for some time in every likely spot I could think of with little result ; one or two of them were killed by hyænas. At last a panther killed one and I had *bandobast* made for sitting up over the carcase, or what remained of it, in the evening. The *bandobast* consisted of a platform placed in a mowra tree, twenty feet from the ground and some twenty yards from the kill. The platform was made of a native cot: a wooden frame-work with string netting to lie on; leaf screens were built up from the sides of this to a height of a couple of feet, with a square window towards the kill. The goat had been dragged some seven or eight hundred yards and placed on the side of a small nala in high grass—a nala which had, in this place, just freed itself from the forest-covered hills and got into level country: old cultivation without any sign of trees or bushes: only some grass along the nala in a band of about twenty yards wide, and a few green bushes and a little elephant grass in the nala bed. The forest ended where the kill was in a point formed by two great spreading, fairly leafy mowra trees, in the outer one of which was my platform. The other large mowra tree was to my right as I faced the carcase, and had a thick branch, growing from the opposite side of the trunk to me from some twenty feet up, which nearly touched the ground with its end twigs. I could not see this branch from where I was sitting. Shortly after I had arrived in my platform, about five o'clock in the afternoon, I saw the panther come down the nala and jump up on to the side in the high grass some twenty yards above the kill; there it stood for some time. When it first appeared I got my rifle on to the goat through the window, and was afraid to move while the beast remained standing; but, at last, the position became so irksome that I was forced to alter it, which I did with great caution, taking my eyes off the panther for a moment. When I looked again there was no panther to be seen but, after some intent looking at the place where it had been, I thought I could discern spots low down in the grass and presumed the animal was lying down in the same spot—a presumption strengthened by the fact that several small warblers were swearing just in that place. Thinking that the panther might be looking at the platform, I remained motionless as long as was possible—the cot made a very uncomfortable and confined seat, leaving no room for one's legs—but again was forced to move. In so doing I happened to look at the base of the next tree—the other mowra tree, just ten yards off, and found myself staring into a pair of green eyes; there was the beast, its head and shoulders just free of the tree-trunk, gazing intently up at the platform! I stopped all motion abruptly. The panther must have kept its eyes fixed, without movement of any sort, for at least five minutes after I saw it; how long it had been looking before that it is impossible to say. Suddenly it ducked its head as if trying to look through the bottom of the platform and assuming a crouching attitude commenced to move forward exactly as if stalking something. With the belly nearly touching the ground, tail just kept clear of the surface, with the tip a little curled up, head stretched out, ears laid slightly back, it glided along, the front leg stretched out to its full length at each step, the foot brought down gently but firmly, moved to this side or that to avoid noise as occasion required, its movements quite inaudible. It went forward and away from me, round in a curve, keeping a watch on the platform over its shoulder most of the time; occasionally stopping to take a longer look, but never altering the crouching attitude. Whenever I got a chance—that is when the panther took its eyes off the platform—I moved the rifle round a bit so as to get it pointed in the direction of the beast. Finally the panther reached the point of the large branch of the next tree which I have mentioned above, just glided up on to it, and disappeared. I knew then what it was after, and brought the muzzle of the rifle round quickly to bear on the trunk of the tree through the leaf-screen. Presently a head appeared round the trunk, just a head, on a level with the platform and with the eyes fixed intently on it, looking for all it was worth. It cannot have been ten yards off, and as it was getting dusk, I brought the rifle to bear on the left eye and fired. When the smoke cleared the head was still there, still staring in the self-same position, motionless! I immediately fired again, and the body fell to the ground with a thud, rolled over once, the tail twitched, and all was quiet. On getting down I discovered that one bullet had pierced the neck just at the base of the skull on the left side, hitting the spine and splintering it. Of the other bullet there was no trace.

There can be little doubt that this animal knew there was some one in the tree, but not being able to see clearly owing to the leaves came to the conclusion that there might be a chance of a meal. She (it was a pantheress) had, in all probability, had some experience of a man on a platform before in a tree; it is quite on the cards that she had taken a man out of one and eaten him. That would explain her boldness in stalking me. It is possible that, seeing a slight motion, she thought that there was some one asleep on the platform; and she came to investigate with the idea of attacking if all were favourable. I cannot explain her not moving or paying any attention to the first shot; that, to my mind, is more extraordinary than the fact of her having stalked me. I have seen many panthers, some hundreds probably, but never yet have I known one remain in the same place motionless after a shot.

I may mention that this pantheress had three young ones inside her, which in the ordinary course would have seen the light in three or four days; she was in beautiful condition and young; probably not more than four years old.

T. R. D. BELL.

KHANDESH, *May*, 1903.

No. III.—THE FOUR-HORNED ANTELOPE (*TETRACERUS QUADRICORNIS*).

Might I enquire whether any members of the Society have noticed a difference in the colour of the tongue between the buck and doe of the above Antelope? In a pair now at Dharwar the buck has a black-coloured tongue, while that of the doe is flesh-coloured. If this difference is general between the sexes, it would be interesting to account for its use.

G. S. RODON, MAJOR.

DHARWAR, 20*th* *May*, 1903.

No. IV.—THE NESTING OF THE YELLOW-BROWED BULBUL (*IOLE ICTERICA*) AND THE SPOTTED BABBLER (*PELLORNEUM RUFICEPS*).

Oates, when compiling "Hume's Nests and Eggs of Indian Birds," had apparently very little information regarding the habits of the above birds. As I have found both their nests this season, my notes on them may be of interest to those who follow birds' nesting as a pleasure.

I found the Yellow-browed Bulbul fairly common on the Sahayadris, south of Satara and also at Ootacamund. This year, not far from Khandalla, I came on it again, though not in numbers. It is a shy, retiring bird ; the best way of obtaining a view is to sit quiet in the jungle, when it is sure to be seen. The bird has a low soft whistle and moves rapidly, flying low from one shrub to another. I found a nest on the 9th April, which unfortunately contained two young birds a few days old. It was placed in the fork of a sapling about 12 to 15 feet from the ground, being swung cradle-like similar to the Oriole. It was quite visible, no attempt being made to select a site concealed by leaves. The small tree, on which it was built, was in a dense jungle, so far as shade was concerned, though there was no undergrowth to speak of. I watched by the nest till the parent appeared. She was evidently fidgetty, as it took her some little while to approach the nest and feed the young.

The Spotted Babbler is also a very timid, shy bird ; it usually clears off as soon as possible if any one is about ; hence it has probably been overlooked a good deal. I came on any number at Matheran. The bird is fond of thick jungle, in which it wanders about on the ground, very like a lark, and turns over leaves in search of moths, several of which I saw captured. It possesses some rather good notes, not unlike the Nilgiri Flycatcher, which it utters at intervals. It was some time before I was able to discover the owner of these notes, as the bird usually stops on any one approaching. I found a nest on the 20th May at Matheran, by the bird darting out from almost under my feet. It was situated on the ground against a small rock, nicely sheltered, not far from a path. The nest is round with an entrance at one side, not unlike that of the Southern Scimitar Babbler (*P. horsfieldii*) and composed of dry leaves, lined with fine grass, stems and roots ; as it was more or less embedded in leaves it is a nest difficult to find unless the bird betrays it by leaving on one's approach. There were three fresh eggs, which I left for a day, but no more were laid. They have a greyish-white ground and are thickly speckled with brown and lilac, so much so that the ground colour is difficult to distinguish. They are not unlike some types of *Thamnobia*. The dimensions of the three eggs approximately are as follows :— ·86″ × ·65″ ; ·85″ × ·66″ ; ·82″ × 65″.

R. M. BETHAM, MAJOR,
8th Bombay Infantry.

POONA, 25*th May*, 1903.

No. V.—FOOD OF *DRYOPHIS MYCTERIZANS*.

The following note on the food of *Dryophis mycterizans* may be of some interest.

When out shooting on the 7th April (evening) my attention was attracted by something moving in a bush close to the path along which I was going ; on going up to see what the cause of it was, I found a very large specimen of *Dryophis mycterizans* tackling a fair-sized *Tropidonotus stolatus*. I watched the pair for some time, in fact until I had satisfied myself that *mycterizans* by having got the head and neck of the other snake down its throat intended making a meal of him. This was confirmed the next morning, for on passing the same way I found the snake (*Dryophis mycterizans*) coiled up asleep and gorged on the same bush.

A. M. PRIMROSE.

TERREMIA TEA ESTATE,
KULLAKUMBAY P.O., NILGIRIS.
May, 1903.

[NOTE.—The above is another instance of cannibalism in snakes. Quite recently in our Museum we had a live *Coluber helena*, which twice attempted to swallow a very attractive looking golden tree-snake (*Chrysopela ornata*). The latter was fortunately rescued. The same day a young Dhàman (*Zamenis mucosus*) measuring about 24 inches in length attempted to swallow a beautiful specimen of *Oligodon subgriseus*, and to-day a young *Gongylophis conicus* attempted to devour a young *Tropidonotus piscator*. In each case the intended victim was a new arrival to the cage, and possibly was looked on as an unwelcome intruder. But from the number of instances that have happened it appears to be a fairly common occurrence for snakes to feed on each other.

W. S. MILLARD,
Hony. Secy., Bombay Natl. Hist. Society.]

8th June, 1903.

No. VI.—NOTE ON *CLANGULA GLAUCION* (THE GOLDEN-EYE).

On the 25th of April I had the skin of a duck sent me by Mr. Morton Eden to identify, which proved to be that of a female Golden-eye. With the skin Mr. Morton Eden sent the following note: "I think it is a Golden-eye............ it is not a rare bird above Sampura." In answer to a letter from me Mr. Eden then sent me the following interesting notes on what he had observed. He writes: "I shot this bird on the 3rd of February last a few miles above Sampura. I was coming down stream at the time when the bird, which was by itself, got up a long way down and flew up stream, passing my boat at a distance of some 50 yards, and I fired at and dropped it.

"Above Sampura up to and beyond Sidaroo, Golden-eyes are not at all uncommon, and I must have seen a hundred or more last January and February. They occur either singly or in small flocks of eight or ten birds; they are wild and will not let a boat anywhere near them, but rise 100 to 150 yards off, and generally make a fairly long flight before again settling.

"They always flew off when disturbed, and I never saw them try to escape by diving.

"In the early mornings I saw them, on several occasions, flighting in company with Mergansers. Their flight is rapid, much like that of a Tufted Pochard, but not quite, I think, so rapid as that of a White-eyed Pochard.

"I may mention that I shot a Golden-eye about 10 miles from here in the cold weather of 1885-6. I sent the skin down to Calcutta, and I think they have it in the Indian Museum."

The rivers mentioned by Mr. Morton Eden in the first part of his notes are in Sadiya, and are practically hill rivers of rapid running clear water. They are of considerable size, even when they just debouch from the mountains, and are the haunt of Mergansers, Golden-eyes, and probably many other rare water birds.

The second bird mentioned as having been shot in 1885-6 was killed in the Sibsagar district.

E C. STUART BAKER, F. Z. S.

DIBRUGARH, ASSAM,
30th May, 1903.

No. VII.—THE ENEMIES OF BUTTERFLIES.

In the course of a most interesting paper " On the Bionomics of South African Insects," published in Part III of the Transactions of the Entomological Society for 1902, and which includes a few records from India and Burma, Lt.-Col. Yerbury sums up his observations as follows :—

> " As regards my experience of birds catching butterflies, it appears to have occurred more frequently in damp than in dry districts ; *e. g.*, it was frequent in Ceylon, rare in places with moderate or small rainfall, such as Campbellpore, Poona and Aden.
>
> " In my opinion an all-sufficient reason for the rarity of the occurrence exists in the fact that in butterflies the edible matter is a minimum, while the inedible, wings, etc., is a maximum."

Lt.-Col. Bingham adds some instances from his experiences in Burma, giving the names of the birds and captured butterflies.

During the past ten years I have been almost exclusively at more or less dry stations, *viz.*, Bhuj, Poona, Aden, Deesa, and Quetta. My own observations as to the rarity of the attacks by birds on butterflies tend to confirm those of Col. Yerbury. I have unfortunately made no notes on the subject, but, speaking from memory, I can only recall a few instances of birds actually catching butterflies which I have witnessed. The birds were two species of Bee-eater (*Merops viridis* and *M. apiaster*), the Roller (*Coracias indica*), and the King-crow (*Dicrurus ater*). Of the victims I can remember only one with any certainty, *viz.*, a Lycænid, probably *Polyommatus boeticus,* which I saw captured by a Bee-eater (*M. apiaster*) in Kashmir. I have seen one or two other birds make a dash at a butterfly, and pursue it without catching it, as puppies sometimes do, but this may have been mere playfulness.

In the dry districts where I have been stationed, the larger *Asilidæ* (predacious flies) take some toll of butterflies, and especially day-flying moths. At Quetta there is a large Asilid, 1¼ inches long, which is most voracious, and apparently preys upon insects of all orders. I have several times seen this fly catch *Pyrameis cardui,* and have subsequently captured it with its prey.

I have not, so far as I can remember, seen dragonflies catch butterflies, though they prey on many insects, and possibly they sometimes capture a butterfly.

Lizards, too, seem to confine their attacks chiefly to insects of other families, though I once saw a lizard catch a small Hesperid *(Gegenes arsana).*

It would, I think, be interesting if other members of the Bombay Natural History Society would record their experiences in the matter.

C. G. NURSE, Major,
13th Bombay Infantry.

Quetta, *June*, 1903.

No. VIII.—CURIOUS ACCIDENT TO A KINGFISHER.

I have received the following note from the Hon'ble Mr. C. S. Bayley, A.G.G in Central India, describing a curious accident to the common Kingfisher *(Alcedo ispida)*:—

"When I was on the river the other day I saw a little turquoise-coloured "thing splashing about in the water. I fished it out and found that it was "one of the small Kingfishers. It had somehow contrived to get its long "beak through the upper part of its left wing and could not get it out. Con-"sequently its head was twisted round and it was drowning fast. I managed to "gently pull the beak out. The bird rested on my hand for about a minute, "gave me a little parting peck and flew away none the worse. How it had "managed to tie itself into such an extraordinary knot I have no idea."

Could it possibly have transfixed its own wing in making a dart into the water? It would be interesting to hear if any member of the Society has ever met with a similar case.

E. C. CHOLMONDELEY.

Indore, C. I., *June*, 1903.

No. IX.—LATE STAY OF THE SHELDRAKE (*TADORNA CORNUTA*) IN TIRHUT AND PECULIAR FORM OF ALBINISM IN THE COMMON HERON (*ARDEA CINEREA*).

A fine male Sheldrake was brought me by a *mirshikar* on the 11th of May. It was caught on a large *chaur* in this district. This is very late for this species, as most have left India before the middle of April. Sheldrakes are very rare in this district. I also got on the same date a peculiar form of albinism in *Ardea cinerea*. I append a description of the same. Head and neck and lower plumage white, except crest, which is brown, the longer feathers being very dark. There are also some buffy brown feathers on the forehead, and the lower neck is streaked with buffy brown and dark brown. There is also an interrupted brown collar on the breast. Sides of body, axillaries and under wing coverts pale ashy brown; upper back brownish-buff, the bases of all and the tips of some of the feathers being white; lower back ashy-grey; primaries and secondaries pale buff with the broad portions of inner webs tinged with brown, the three innermost primaries and their coverts being dark brown; tertiaries ashy-brown; lesser wing coverts white, remaining coverts buffy white; tail buff, brownish at base except the central feathers, which have white instead of buff. Colours of soft parts same as in ordinary specimens, except the legs, which are dirty flesh colour.

CHAS. M. INGLIS.

Baghownie Fcty., Darbhanga, Bengal.
18th June, 1903.

No. X.—NOTES ON BIRDS NEAR QUETTA.

(*Continued from Page* 601, *Vol. XIV.*)

Dendrocopus sindianus—Sind Pied Woodpecker.—Common at Shelabagh at the mouth of the Khojak Tunnel on the Khwaja Amram range. Not observed elsewhere.

Iynx torquilla—Common Wryneck.—A constant visitor on migration in April. Have observed a few every year.

Coracias garrula—European Roller.—This bird is very common round Quetta in May. I have not observed it after about the middle of June, and I do not think it breeds anywhere near.

Merops apiaster—European Bee-eater.—Arrives in large numbers towards the end of April. Some remain all the hot weather, and probably breed,—in fact, Major Nurse, 13th Bombay Infantry, has, I believe, actually observed them doing so.

Alcedo ispida—Common Kingfisher.—Fairly common in the spring. I have also seen one in December. Does not breed here as far as I know.

Upupa epops—European Hoopoe.—Arrives in March or April. Breeds. One nest in a hole in rocks with young, May 18th.

Cypselus melba—Alpine Swift.—Arrives about the end of April or May. Fairly common in the hills. Very probably breeds, as I have seen them high up in the hills at the end of June.

Cypselus apus—European Swift.—This is the commonest swift near Quetta. Arrives about the beginning of May in large numbers. Some undoubtedly breed in the hills, as I found nests on May 31st in the roof of a cave. The nests were inaccessible, but I observed the old birds feeding the young from close to for some time.

Cypselus affinis—Common Indian Swift.—Common in the hot weather, but not so plentiful as the last. Arrives at the end of April. Breeds. Three nests with fresh eggs in the roof of a cave, May 17th.

Caprimulgus europœus—European Nightjar.—Fairly common in the hot weather. Probably breeds, as I have observed it throughout the hot weather.

Cuculus canorus—Cuckoo.—Very common. On migration in March and April.

Bubo ignavus—Great-horned Owl or Eagle Owl.—Shot one in the hills in November and saw others.

Athene bactriana—Hutton's Owlet.—This is fairly common round Quetta in the cold weather. I have seen it in March, but do not think it remains to breed.

Vultur monachus—Cinereus Vulture.—This is common round Quetta. It breeds in the hills near, making a large nest at the top of a juniper tree, very often on one growing out from a cliff. I have found a fair number of nests this year, and have got an egg as described in "Fauna of British India Birds," Vol. III. The nests had mostly young birds lately hatched on May 5th.

Gyps fulvus—Griffon Vulture.—Very common. Breeds in the hills, nesting on cliffs. The natives say that it also nests in the juniper trees. I found one nest of this bird this year high up on a cliff. The young bird was hatched about April 25th.

Neophron percnopterus—Egyptian Vulture, or Large White Scavenger Vulture.—Common in the hot weather. Arrives about beginning of March. Breeds in the hills, making a nest on cliffs.

Gypaëtus barbatus—Bearded Vulture, or Lammergeyer.—Very common round Quetta. Breeds in the hills, usually in very difficult situations. One nest with young beginning of April. One nest with one egg on which the bird was sitting, but which proved to be addled, March 6th.

Hieraëtus fasciatus—Bonelli's Eagle.—Not common in the hills. Some breed in the hills near. Nest, May 14th, one egg hard set. Nest, May 26th, two eggs slightly set.

Milvus govinda—Common Pariah Kite.—Common all the year, but numbers vary greatly, getting very scarce in the cold weather.

Milvus migrans—Black Kite.—Breeds in the hills near Quetta in a good many places, or rocky cliffs, about the middle of April. I got three fresh eggs from one nest about April 12th.

Circus macrurus } Pale Harrier.
Circus cyaneus } Hen Harrier.

I think both of these Harriers frequent Quetta on migration in the spring. I have certainly shot the latter, and I think the former very common from middle of March to middle or end of April.

Circus æruginosus—Marsh Harrier.—Fairly common in suitable places in the cold weather. At Khushdil Khan, in an open piece of water, about 40 miles from Quetta, they were very common in March.

Buteo ferox—Long-legged Buzzard.—This is common in the cold weather, chiefly the dark form. I think perhaps some breed in the hills, as I have observed them at the end of April and have had eggs brought me by a native on one occasion which, I think, must have belonged to this bird.

Accipiter nisus—Sparrow Hawk.—Not common. On migration about April.

Falco jugger—Laggar Falcon.—Fairly common in the cold weather. Some, I think, breed, as I observed a pair in April, who were, as far as I could see, building a nest high up on the face of a cliff.

Tinnunculus alaudarius—Kestrel.—Common. Breeds on cliffs in the hills. I have found a good many nests, but most of them were inaccessible. Took four fresh eggs from one on May 14th.

Columba intermedia } Indian Blue Rock Pigeon.
Columba livia } Blue Rock Pigeon.

I have shot both these birds in Quetta, the former being the most numerous. Very common, forming large flocks in the cold weather. Breeds down the *kurezas*, or underground water channels, peculiar to this part of the world.

Palumbus casiotis—Eastern Wood Pigeon, Ring Dove or Cushat.—Common in the juniper forests round Ziarat at about 10,000 feet; also nearer Quetta on the higher hills.

Turtur cambayensis—Little Brown Dove.—Very common in spring and summer. Breeds about end of April and beginning of May. Some birds remain throughout the winter.

Turtur risorius—Indian Ring Dove.—Common in spring and summer. Breeds later than last named about middle of May.

Pterocles arenarius—Large or Black-bellied Sand Grouse.—Passes through in large numbers on migration in spring and autumn. Some appear to remain very late right on to December.

Pteroclurus alchata—Large Pin-tailed Sand Grouse.—On migration in spring and autumn like the last named, but does not appear to remain so late.

Coturnix communis—Common or Grey Quail.—Not numerous. Stragglers are always to be found about migration in spring and autumn.

Caccabis chukar—Chukor.—Very common on all the hills. Breeds freely.

Ammoperdix conhami—Seesee.—Very common. Frequents lower ground than the last named. Breeds.

Francolinus vulgaris—Black Partridge or Common Francolin.—This bird gets up as high as Babar Kuchh in the lower hills not far from Sibi and probably higher, though I have not observed it myself.

Porphyrio poliocephalus—Purple Moorhen.—I saw this bird in a small river near Quetta in thick reeds in August. I think that they had probably bred near there, as there were seven or eight together, apparently one family.

Fulica atra—Coot.—Very common on the open tank at Khushdil Khan, about 40 miles from Quetta, in the cold weather. I do not know if this bird remains to breed or not.

Houbara macqueeni—Houbara.—Passes through on migration in fairly large numbers about the end of March and April.

Œdicnemus scolopax—Stone Curlew.—One was shot out of a pair in very cold weather in March.

Cursorius gallicus—Cream-coloured Courser.—Not common. I shot two out of a small flock once in September and have seen others about the same time, probably on migration.

Sarcogrammus indicus—Red-wattled Lapwing.—I have only seen one near Quetta that was shot in March in very cold weather.

Vanellus vulgaris—Lapwing or Peewit.—Some cold weathers this bird is common, in others rare.

Ægialitis dubia—Little Ringed Plover.—Common in the spring, arriving early in February or March; remains late, as I have observed them in May.

Ægialitis geoffroyi.—Large Sand Plover. One was brought to me in March to identify, which was shot out of a small flock of five or six. I identified it as above, but its dimensions were slightly larger, *viz.*, length 8·75, tail 2·5, wing 5·8, tarsus 1·5, bill from gape 1·1.

Himantopus candidus—Black-winged Stilt.—Common at Khushdil Khan in March.

Totanus hypoleucus—Common Sandpiper.—Not common. The only ones I have observed were in April.

Totanus ochropus—Green Sandpiper.—This bird is common in the cold weather, but not in large numbers ; remains late, as I have seen them in May.

Pavoncella pugnax—Ruff and Reeve.—I shot one in February, a female.

Scolopax rusticula—Wood Cock.—A few are shot every cold weather round Quetta.

Gallinago cœlestis—Common Snipe, Full or Fan-tail Snipe.—In suitable places in the cold weather; not numerous, as there is very little ground for them.

Gallinago gallinula—Jack Snipe.—Met with occasionally in the cold weather.

Larus ridibundus—Laughing Gull.—I saw large flocks of this gull on Khushdil Khan tank in March. They are fairly common in the cold weather.

Pelecanus roseus—Eastern White Pelican.—Have seen them migrating at Batar Kuchh in February.

Phalacrocorax carbo—Large Cormorant.—I saw a few at Khushdil Khan in March; not common.

Ardea cinerea—Common Heron.—Not uncommon in suitable places in the cold weather; they were numerous at Khushdil Khan in March.

Herodias alba—Large Egret.—Fairly numerous at Khushdil Khan in February.

Phœnicopterus roseus—Common Flamingo.—I saw a large flock of these birds, probably 200 or 300, at Khushdil Khan in March, I suppose migrating, as they did not alight.

Tadorna cornuta—Sheldrake.—Rare. I saw two at Khushdil Khan tank in March, but did not shoot one.

Casarca rutila—Ruddy Sheldrake, or Brahminy Duck.—Passes through in February-March.

Anas boscas—Mallard.—Common in the cold weather in suitable places.

Nettium crecca—Common Teal.—Common in the cold weather in suitable places.

Dafila acuta—Pintail.—Generally distributed in suitable places in the cold weather; not very numerous.

Spatula clypeata—Shoveller.—Fairly numerous in suitable places in the cold weather.

Marmoronetta angustirosiris—Marbled Duck.—Not common. I shot two at Khoshdil Khan in February, but there were not many there at that time.

Netta rufina—Red-crested Pochard.—Common in suitable localities in the cold weather.

Nyroca ferina—Pochard or Dunbird.—Common in suitable localities in the cold weather.

Nyroea ferruginea—White-eyed Duck.—Not very numerous. A fair number in February at Khushdil Khan.

Nyroca fuligula—Tufted Duck.—This bird was common in Khushdil Khan tank in March, but in February there were very few.

Erismatura leucocephala—White-headed Duck.—I saw a lot of about six in Khushdil Khan in February, of which I shot two.

Mergus albellus—Smew.—Common in the cold weather in suitable places.

Podicipes albipennis—Indian Little Grebe or Dabchick.—This bird was common at Khushdil Khan in February-March.

Since the first part of this paper was written I have made the following further notes :—

Turdus viscivorus—Missel Thrush.—I found a nest of this bird this year, placed in a juniper tree about ten feet from the ground, at about 8,000 feet elevation. It contained four eggs slightly incubated on May 1st.

Oriolus kundoo—Indian Oriole.—This bird is much more common than usual this year. I have seen three or four pairs near Quetta about May 10th.

Sylvia Jerdoni—The Eastern Orphean Warbler.—I found a nest of this bird on May 17th this year ; it was placed at the end of a drooping branch of a fair-sized tree, about ten feet from the ground and rather difficult to get at : the nest was composed of thin sticks outside, and lined with fibres ; there were no feathers or hair in its composition ; it was of rather flimsy construction. The bird was sitting on the nest at the time, and I had no difficulty in identifying it, more especially as I know the bird well. The nest contained three nearly fresh eggs, rather broad ovals, white with spots of two or more shades of green ; the spots were thicker towards the large end, but nowhere very thick.

Saxicola deserti—The Desert Chat.—I found a nest of this bird on May 24th. It was placed on the side of a bare bank of mud about ten or fifteen feet high, and was concealed under the root of a small dead shrub ; it was composed of roots and fibres, and contained three young birds nearly fledged.

I have also made sure of the large Eagle of these parts since I sent my notes. A Pathan brought one in the other day, which I had no difficulty in identifying as a male Golden Eagle, *Aquila chrysaëtus*. I have little doubt that the eggs—one last year and one this—belong to this bird. The Pathan who brought the eggs showed me the nest this year, high up on a cliff and some way in the hills, and assured me that it belonged to the same sort of bird that he had shot and brought in to me.

T. E. MARSHALL, CAPT., R.A.

QUETTA, *June*, 1903.

No. XI.—SAMBAR KILLED BY WILD DOGS.

It may interest the members of the Society, and perhaps call forth some personal experiences, if I give the following short account of a sámbar (*Cervus unicolor*) that I found killed by wild dogs in the Poonassa division of the Nimar district, Central Provinces, on the 26th May this year, while on a short shooting trip to the Nerbudda Valley. I had sent my pony on by a short cut to a pool, while I took a round of the hills looking for sámbar and bear, and getting back to this pool about 11-30 could not at first see the extra men and syce with the pony, as they had gone on some little distance from the water, half lying in which I found a full-grown sámbar stag with horns in velvet. The villager whom I had sent with the syce and pony to the pool then pointed out some reddish jackal-like forms sneaking about in the bushes to the right, and these I made out to be three wild dogs. I then sent all the men, except the shikari, away and tried and did succeed in getting shots at two of the dogs, who although loth to go away yet kept to the undergrowth, so that my 303 bullets split up on twigs and I did not succeed in bagging one. I had only a hollow-fronted bullet by Kynoch & Co. with me, besides a 10-bore rifle. After the third shot they went away and the shikari said would not return at all to this kill. Had I waited a longer time I could no doubt have had a shot in the more open forest near to the pool, but I could not do so being far from camp and late. I then examined the carcass of the dead sámbar and found it quite fresh, so decided to take some of the meat and also have it skinned.

The animal seemed to have been killed by being seized by the throat, the neck appearing almost severed from the body, and a large piece of the wind-pipe torn right out and flung to one side. The latter measured nine inches in length. The testes I found intact and untouched ; the hind parts also had not been mauled, from which I came to the conclusion that the sámbar had been suddenly seized while drinking at the pool and not chased and run down, as in the latter case the quarry is invariably emasculated and pieces torn out of the inner parts of the thighs, where the dogs who have failed to catch the testes have taken pieces out of the first part struck with their teeth. The ears I found untouched, as also the head, except that the velvet of the horns had in two places been gnawed through, no doubt as the animal lay on its side after death. The sámbar was beautifully disembowelled, and the whole of the viscera carried away some distance from the pool, the carcass being partly skinned, one leg only being torn off and missing. The skin however when taken off made a perfect pelt, so neatly had the dogs done their skinning.

From splashes of blood high up on the trees near the pool, and from the churned up state of the pool itself, I should think that the struggle that went on in the early hours of the morning must have been both fearful and prolonged. The shikari said the beast had been knocked down about 5 a.m., and told me that there were two packs of dogs in the forest—one frequenting the Poonassa and one the Changarh jungles. He thought these three dogs were no doubt part of the Poonassa pack. The dead sámbar appeared to me as if it had only been tackled by the three dogs.

REGINALD H. HEATH.

Sirsa, *June*, 1903.

No. XII.—FURTHER NOTES ON KONKAN BUTTERFLIES.

Since the publication of our paper on the butterflies of the Konkan, I am now able to add the following notes on several species from observations at Pali Hill near Bandra and during short visits to Khandalla and Matheran. They merely go, I fear, to show the incompleteness of our list and the information regarding many of the species included therein, but will, I hope, encourage others to give their assistance in filling up the gaps.

(33) *Symphædra nais* (Forster).—I observed this on two occasions between the second and third milestones going from Neral up to Matheran, so it would not appear that it is so entirely confined to the coast as we had been led to imagine.

(38) *Kallima horsfieldii* (Kollar).—Towards the end of April I saw an unmistakeable specimen of this close to the convent at Bandra. It was quite common at Matheran during the same month.

(43) *Spalgis epius* (Westwood).—Our note made no reference to this on the hills. I took it at Khandalla in February.

(49) *Lycænesthes lycænina* (Felder).—I took this species at Pali Hill on 1st February and also at Matheran in April, where it was by no means uncommon.

(50) *Talicada nyseus* (Guerin).—Although this may be expected anywhere where its food plant (*Bryophyllum calycinum*) occurs, it may be worth recording that I found it both at Khandalla in February and at Matheran in April. At the latter it was numerous about patches of the food plant by Charlotte Lake and in the compound of Elphinstone Lodge.

(51) *Jamides bochus* (Cramer).—Our note made no mention of this being found on the hills, and it was included in none of the lists we had access to of Matheran butterflies. I found it quite common there in April.

(New) *Nacaduba* sp. ?.—I took a small dark species both at Pali Hill in February and a number at Matheran in May, but am unable to assign them to any species for certain. There appears to be much confusion as to what are good species in this genus, and my specimens may be referred to some form of either—*N. ardates* (Moore)= *noreia* (Felder) or to *N. atrata* (Horsfield).

(New) *Arhopala centaurus* (Fabr).—At Matheran both this and *A. amantes* were by no means uncommon in April.

(New) *Rapala orseis* (Hewitson).—My specimens collected at Matheran include unquestionable male and female of this species.

(83) *Terias libythea* (Fabr).—This species was not uncommon at Khandalla in February.

(102) *Papilio nomius* (Esper).—During visits to Vehar Lake in Salsette in March and April, Mr. E. H. Aitken repeatedly observed specimens of this, and I watched one that was settled on a bush within two yards of me for some minutes during the last week in June at Pali Hill, so it is evidently not so rare as we believed.

(110) *Sarangesa purendra* (Moore).—Mr. E. H. Aitken found this species by no means uncommon at Vehar in March, and I took several at Matheran in April.

(111) *Sarangesa dasahara* (Moore).—I also took several specimens of this species at Matheran.

E. COMBER.

BOMBAY, *July*, 1903.

No. XIII.—THE GOLDEN CAT *(FELIS TEMMINCKI)*.

In regard to the habits of this cat, the skin and skull of which I sent to the Society's museum recently, the Lushais, who recognize it as a distinct species and call it Kei-shen (Red-cat), say it lies up in rocks and does not climb trees. It lives on kids, fowls, and small wild animals. The specimen I sent to the Society's museum was killed in a nullah, 6 miles from Aijal, at an elevation of about 1,000 feet.

L. O. CLARKE, I.C.S.

AIJAL, LUSHAI HILLS, ASSAM, *June*, 1903.

No. XIV.—Dr. CALMETTE'S ANTITOXIC SERUM AND THE POISON OF THE DABOIA *(VIPERA RUSSELLI).*

In the exceedingly interesting and informing article on "Snake Bites and Poisonous Fishes" which appeared in the last number of the Journal (No. 1 of Vol. XV), there appears a statement which, in the light of recent experiments carried out in India by an expert on snake poisons, should I think, in the general interests of a very important subject, be noticed—specially for the sake of those who may carry about Calmette's serum with a feeling that it is absolutely reliable. In the above articles it is stated that Calmette's antitoxic serum will "immunise animals and man from lethal doses of *any* venom, although each snake venom has *per se* well marked tonic peculiarities producing several and various local phenomena." But, so far as I have been reliably informed, it has been ascertained that although Dr. Calmette's serum is undoubtedly efficient in counteracting the venom of cobras, it is *not* so in the case of the poison of the Russell's Viper or Daboia.

G. S. RODON, Major.

Dharwar, 23*rd July*, 1903.

No. XV.—FEROCITY OF THE HAMADRYAD OR KING-COBRA *(NAIA BUNGARUS).*

I am sending you a snake for identification which bit a coolie woman whilst she was plucking leaf on our tea estate. The woman died about twenty minutes after being bitten. It appears the snake instituted an unprovoked attack on the woman, seizing her by the leg and hanging on but not attempting to wind round her body. The woman was absolutely paralyzed with fear, and apparently did nothing to try and free herself. The other coolie women who were plucking the same plot of tea at once went off to get help, but it was not until some coolie men arrived on the scene that the snake released its hold and made off. The men gave chase and managed to kill it, and they assert that when pressed the snake attacked them.

I should feel much obliged if you would kindly enlighten me on the following points :—(1) What kind of snake it is? (2) Whether it is usual for this kind of snake to attack people, and why it hung on so long to the woman's leg? It had hold of her for quite eight minutes and could have easily let go had it so wished, because it did so immediately the men approached to kill it. (3) Whether the snake is venomous, or if the woman simply died of fright? I am not inclined to believe the latter myself, because she was a strong healthy woman, and seemed quite re-assured when I told her that the snake was not venomous.

The symptoms were : much pain and swelling of part bitten, vomiting, difficulty in breathing, total prostration, and then death.

The length of the snake was 10 feet 1 inch; circumference, thickest part, 11½ inches.

Prompt measures were taken by my native Doctor Babu to try and save the woman's life.

W. RABY NOBLE.

BARGANJ, T. E., BEHALLI, ASSAM.
17*th July*, 1903.

[The snake sent is undoubtedly a Hamadryad or King-Cobra *(Naia bungarus)*—which is noted for its ferocity,—although fortunately not often to such an extent as the above. It may possibly have had its nest somewhere in the vicinity, which might account for its exceptional fierceness.—ED.]

No. XVI.—NOTES ON THE INSECTS OF QUETTA.

At the request of Mr. R. Hughes-Buller, I.C.S., who is in charge of the "Gazetteer of Baluchistan," now in course of compilation, I made some notes on the insects to be found near Quetta. As they may perhaps interest members of the Bombay Natural History Society, Mr. Hughes-Buller has kindly consented to their publication in the Society's Journal.

The following remarks refer exclusively to the insects found near Quetta and Peshin, where the writer has had opportunities for collection and observation.

Among the *Orthoptera* two species of locusts are the most conspicuous, and do considerable damage. One of these, *Schistocerca peregrina* frequently called *Acridium peregrinum*, is very widely spread. The other species is probably *Pachytylus cinerascens.* During the present year (1903) the former species appeared in large numbers in March, but a spell of cold weather killed most of them off.

Many species of *Neuroptera* are common, especially dragonflies. These insects serve a most useful purpose in killing large numbers of flies and mosquitoes. I believe that the larvæ of dragonflies also destroy mosquito larvæ. During the present year enormous swarms of a large species of dragonfly appeared in June and July, and to their presence I attribute the comparative scarcity of mosquitoes. *Termitidæ* (white ants) are also numerous, and do some damage, but less than at most places in India. *Myrmelconides* (ant-lions) are not uncommon, and one very large species occurs. Among the lesser known *Neuroptera* a species of *Embia* is found, and I received some years ago from Peshin a species of *Nemoptera,* which is a very remarkable looking insect.

Hymenoptera (bees, wasps, etc.) are very numerous, and as my attention has been chiefly devoted to this family, I will give a somewhat longer account of those that occur in Baluchistan. Situated, as the country is, on the border of the Palæarctic and Oriental regions, the species that occur here comprise many Indian and European species. There is also some resemblance between the *Hymenopterous* fauna of Kashmir and that of Baluchistan. As may be expected, many of the species that occur here have been found in Russian Central Asia, and have been described by Russian naturalists. Sawflies I have not found : they are usually numerous only in well-wooded country. The *Parasitica* are not common ; I obtained a species of *Leucopsis*, one or two *Braconidæ*, a species of *Evania*, besides several *Ichneumonidæ*. The latter are, however, less numerous than might be expected. *Chrysidiæ* (Ruby or Cuckoo Wasps) are common, and numerous species occur. I obtained examples, many of which were hitherto undescribed, of the following genera : *Ellampus, Hedychridium, Hedychrum, Stilbum,* and *Chrysis.* The latter is a large genus, and many species occur. All the species of this family are parasitic on other *Hymenoptera*, and the more conspicuous species, such as *Stilbum splendidum* and *Chrysis orientalis*, may frequently be observed in verandahs, seeking for the nests of their victims, in which they deposit their ova.

The *Apidæ* are numerous, both in species and individuals, but I have never come across a specimen of the true honey bee (*Apis*), though three species occur in India. As soon as the fruit trees come into blossom in the spring, they are surrounded by crowds of bees, chiefly belonging to the genus *Tetralonia*, but *Osmia* and *Andrena* are also represented. Later on in the summer, in addition to the above genera, the following occur—among the short-tongued bees, *Colletes* and *Prosopis* ; among the long-tongued bees, *Sphecodes, Halictus* (many species), *Panurgus, Nomia, Nomada, Megachile* (many species), *Anthidium, Parevespis, Ceratina, Coelioxys, Crocisa, Anthophora* (many species), and one species of Xylocopa. The latter is crepuscular in its habits, frequenting hollyhocks, and its larva feeds on the wood of willow and possibly other trees, usually I believe attacking those that are dead or dying. Specimens of two genera, *Ctnoapis* and *Melanapis*, which have hitherto not been found outside the Punjab and Baluchistan, also occur, the former being very common.

Among the *Diploptera*, or Wasps, several species of each of the following genera are found :—*Eumenes, Odynerus, Polistes* and *Vespa.* The largest species, *Vespa orientalis*, which is brown with a yellow band across the abdomen, frequently nests in the roofs of houses. Several of the common European wasps of the same genus are also found in some numbers.

The *Fossores*, or digging wasps, are well represented. Among these are found the following genera : *Apterogyna, Mutilla*, and *Iswarra*, all having apterous females ; none of them are common here, though occasionally the males come to lights at night. Coming to the *Scollidæ*, another tribe of *Fossores*, two species of *Meria* are common, though the females are seldom seen ; *Scolia* is represented by several species, two of which are large conspicuous insects which are spread throughout the whole of Europe and Central Asia. Two or more species of *Elis* also occur, and one of *Sapyga*, the latter genus not having been found elsewhere in Indian limits.

Another tribe of *Fossores*, the *Ceropalidæ*, till recently called the *Pompilidæ*, is represented by a few large, and many medium-sized and small species. As, however, entomologists have not settled definitely the generic division of this tribe, I will notattempt to enumerate the genera which are found in Baluchistan. The largest species found here, and also perhaps the commonest, is *Salius nicevillei.*

A further tribe of *Fossores*, the *Sphegidæ*, comprises some of the largest and also some of the smallest of existing wasps. Representatives of the following genera occur within our limits: *Tachysphex, Larra, Homogambrus, Notogonia, Liris, Palarus, Miscophus, Gastrosericus, Pison, Trypoxylon, Ammophila, Sceliphron, Sphex, Pemphredon, Passalacus, Diodontus, Gorytes, Stizus, Bembex, Philanthus, Cerceris, Oxybelus*, and *Crabro.*

The *Formicidæ*, or Ants, are numerous in individuals, but not so in species. The largest and most conspicuous ant, frequently found in and about houses is *Myrmecocystus setipes*, which occurs commonly in the Punjab.

Coleoptera (Beetles) are numerous, the most noticeable being various species of Scarabæus, which act the part of scavengers by breaking up and burying the droppings of cattle and other animals in which they lay their eggs. Several species of *Cicindelidæ* (Tiger-beetles) are also common. The willow, poplar, and other trees are much subject to the depredations of some large species of beetles, but I am not certain to what genera these belong.

Of the *Lepidoptera* (buttterflies and moths), the former are not very numerous, at least in the immediate neighbourhood of Quetta. Perhaps the most common is the almost ubiquitous Painted lady (*Pyrameis cardui*). The following are the other butterflies which commonly occur near Quetta: *Ganoris* sp., *Belenois mesentina, Limnas chrysippus, Synchlœ daplidice, Colias* sp., *Teracolus faustus, Hipparchia parisates* and *H. thelephassa, Polyommatus bœticus, Aphnaeus hypargyrus, Chrysophanus phlœas, Azanus ubaldus, Zizera karsandra, Lycæna balucha, L. persica, L. hylas* and *L. bracteata*, with perhaps a few more *Lycænidæ.*

The moths include *Deilephila livornica*, a species of *Macroglossa*, a *Catocala, Tarache sulphuralis*, one or two species of *Plusia*, and many others.

Diptera or flies, which include of course gnats and mosquitoes, are very numerous. Some of them, especially the predatory *Asilidæ*, are of very large size, and prey upon other insects. A species of this latter genus which occurs commonly at Quetta is about 1¼ inches in length, and is most voracious, preying upon butterflies, moths and other insects, sometimes seizing those which are twice its own size and weight. *Culicidæ* (gnats and mosquitoes) are fairly numerous during the summer, a few certainly passing the winter in houses in a state of hybernation. The genus *Anopheles* has attained an unenviable notoriety during the last few years as being the intermediate host of the malarial parasite. Several species of this genus doubtless occur here ; last year (1902) individuals were not numerous, owing to the prevailing drought ; and during the present year I attribute their comparative scarcity, as before mentioned, to the unusual number of dragonflies.

Simuliidæ (sand-flies) are very common, and few escape their irritating attentions. Blood-sucking flies, also frequently called gad-flies, are very numerous at times, and are especially annoying to horses and camels, the females biting them to such an extent as frequently to cause considerable swellings on the abdomen. I have seen several horses during the present year, including one of my own, which were quite unfit for work owing to their bites.

The *Oestridæ* (Bot-flies) are not very frequently seen in the imago state, but some species are certainly numerous, among them *Cephalomyia maculata*, the larva of which comes to maturity in the camel's nostril, causing great irritation.

A species of *Hippobosca* is also common, attacking both horses and dogs.

Among the lesser known classes of insects may be included the *Hemiptera* (bugs), of which a considerable number of various species occur, among them being of course *Cimex lectularius*, so noxious to the human race. *Cicadas*, a species of which appeared in enormous numbers during the present year, are part of this family : the noisy song of the males cannot fail to attract attention. This group is of interest, as the larvæ frequently takes many years to develop, the perfect insect appearing sometimes at intervals of 13 and even 17 years. These insects did some damage to trees during this year, being present in millions : many kinds of birds may have been observed preying on them.

Aphidæ, frequently called plant-lice, do great damage to many fruit trees, and I believe that the galls, which so disfigure many of the poplar trees in and near Quetta, are the work of an insect of this group.

The above is, of course, only a rough outline of the numerous insects which are found near Quetta. In the present state of our knowledge of entomology it is impossible to give anything like a complete list of the insect fauna of any portion of the Indian Empire.

C. G. NURSE, MAJOR,
13th Bombay Infantry.

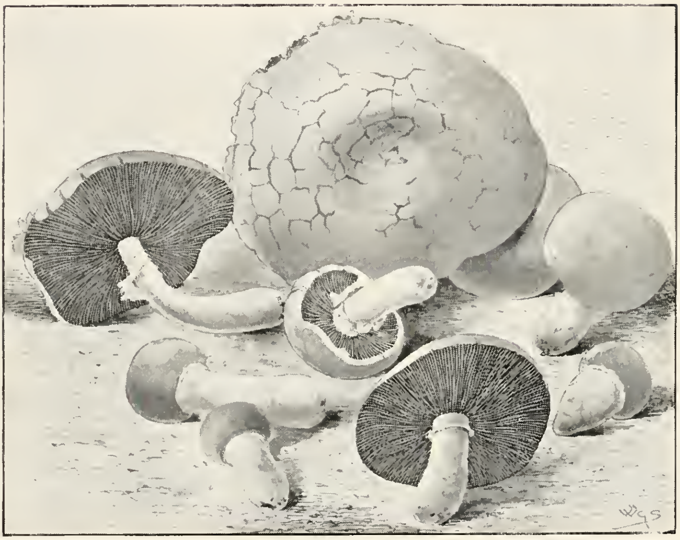
QUETTA, *August*, 1903.

No. XVII.—CURIOUS ACCIDENT TO THE COMMON SWIFT (*CYPSELUS AFFINIS*).

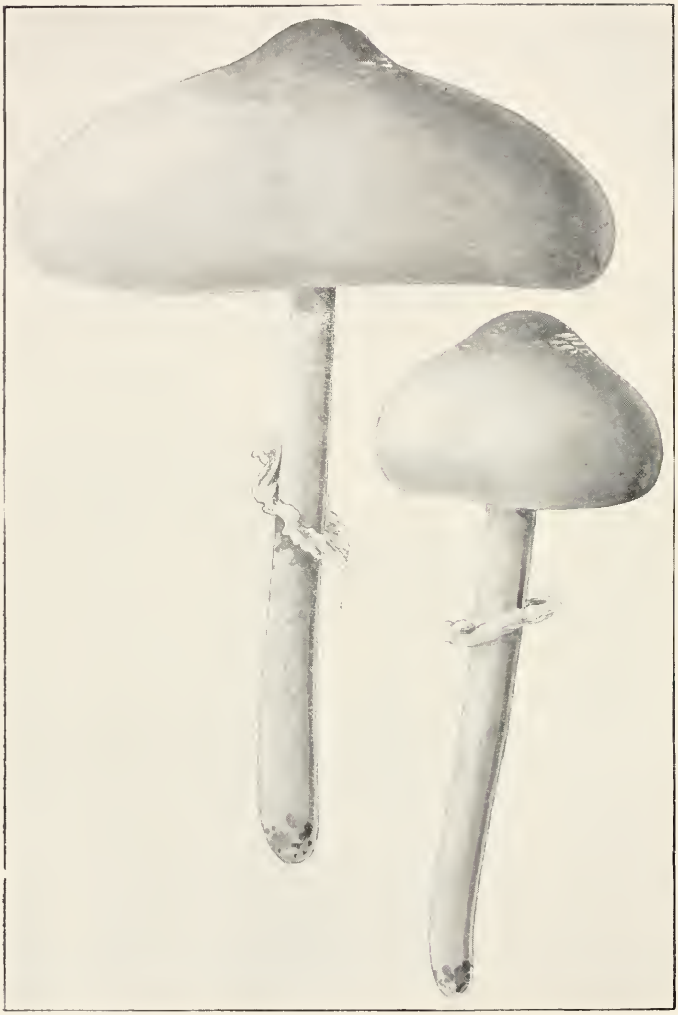
I am sending you an account which I do not think can be called a unique instance of unpremeditated suicide in a bird, but it is nevertheless a case for our sympathy. The little swift I send was found hanging close to its nest strangled by the string which is now attached to it. I think there was a photograph in the "*Strand Magazine*" some time ago of a similar instance, the subject being a sparrow. In the present case the story has the unimpeachable authority of our local vicar ; and the explanation is simple, *viz*, that the string, which is double, was flying loose near the nest and the bird got accidentally caught in it. I send it as given to me, as it may be of interest.

M. D. MACKENZIE.

HYDERABAD (SIND), *August* 4, 1903.



Agaricus Woodrowii, *Massee.*
Poona Brown Mushroom.



Lepiota altissima, *Massee.*

Vern. *alim.*

No. XVIII.—FOUR INTERESTING BOMBAY PLANTS.

LEPIOTA ALTISSIMA, Massee, Kew Bull, 1898, page 114.

(*With a plate.*)

The Giant Mushroom of the Western Ghats, named *Alim* by Khandala people, is a very distinct new species, attaining in the fresh state 10 inches in height and 8 inches in width of cap. The cap is membranaceous, but in the centre somewhat fleshy and with a slight boss; the gills are white, but with age assume a pale yellow. It is eaten by the Ghat people, and is described as follows by Mr. G. Massee :—

Lepiota altissima, Pileus membranaceous, albidus, centro tantum carnosus, e convexo-plano subumbonatus, squamis concentricis innatus subsquarrosus, ad marginem fimbriatus, fibrosus, circiter 8 c.m. latus; Lamellæ liberæ, sub-confertæ albæ, dein pallide flava; Sporæ ovatæ 8 × 5 u; basidia subclavata 28-30 × 8-10 u; Stipes a pileo discretis albus cylindraceus bulbillosus fistullosus tandem usque 25 c.m. longus, apice vix 1 c.m. crassus; annulus persistens, fimbriatus.

AGARICUS WOODROWII, Massee, Kew Bull, 1901, page 151.

THE POONA BROWN MUSHROOM.

(*With a plate.*)

A Mushroom abundant on the golf links at Poona and similar dry upland pastures in the Deccan during a short season about September-October; it attains 4½ inches in width of cap and 4 inches in length of stalk. The cap is nearly globular, but at length becomes umbrella-shaped and irregularly cracked, displaying the white underlayer; the stalk is swollen in the centre, white and as long as the breadth of the cap; the gills and spores brown; and the ring ultimately drying up and disappearing.

It is a valued esculent which might be cultivated with great advantage.

" Ag. Woodrowii, Massee (*Sp. nov*). *Pileus* subglobosus glaber primitus lævis, dein centro rimoso-arcolatus, ex albido fuscescens, 3—5 cm. latus, caro 1 cm. lato, fuscescens. *Lamellæ* confertæ, liberæ sed approximatæ, umbrinæ. *Sporæ*, ellipticæ, glabræ, umbrinæ 8 × 5 u. Stipes ventricosus, albidus, deorsum fuscescens, glaber, 3—5 cm. longus: annulus superus, evanescens "

" On the ground, Poona, Woodrow. Edible. Allied to Agaricus silvaticus, *Schaeff*; distinguished from this and all known species by the ventricose stem and crowded approximate gills."

FREREA INDICA, Dalz. Marathi *Shindul makudi.*

(*With a plate.*)

A very rare plant which commemorates the Bombay Government House Party of *circa* 1865. It is of very local occurrence; found originally by Mr. Dalzell on a hill near Junir and more recently on the same place by Mr. N. B. Ranade, who took plants to Poona which flowered, and the figure ⅔ natural size has been produced from a photograph.

At Poona it proved to be a prostrate herb with thick branches, and the leaves oblong, subsessile, fleshy, 1½ inches in length; flowers, solitary or in pairs, ¾ inch diam., rotate, purplish, fringed with vibratile hairs.

JATROPHA GLANDULIFERA, Roxb., *Undirbibi.*

(*With a plate.*)

Abundant in waste places in Western India. There is a very glandular shrubby species of Jatropha with reddish tinged leaves and red flowers, a naturalised plant from Tropical America known to the people as *Vilyati ratanjok,* the *Jatropha gossypifolia,* Linn. Its special interest lies in the fact that it has been mistaken by Dr. Dymock in his "*Pharmacographia Indica,*" III., 273, and quoted by Mr. Nairne in "*Flowering Plants of Western India,*" page 295, for the subject figured which is the true appurtenant to the name *J. glandulifera,* although it is much less glandular than the species referred to above. Roxburgh describes this plant minutely in the *Flora Indica,* Clarke Ed., page 689, and to it belongs the legend given by Dr. Dymock to the following effect:—A cultivator near Pandarpur was ploughing his field while crowds were passing to meet the palanquins of the gods brought from other temples to Pandarpur, and many passengers asked the cultivator what he was going to sow. Polite for a time, the repeated enquiries became irritating, and to one of the questioners a very rude answer was given; this one happened to be the god Vithoba in disguise, who rejoined, 'As you sow, so may you reap,' and ever after as long as the field was held by a Hindu it produced nothing but Undirbibi. As far as is known, this plant is indigenous only near Pandarpur; the specimen figured was carried to Poona by the writer and photographed while in flower.

G. MARSHALL WOODROW.

KELVINSIDE, GLASGOW, *July,* 1903.

No. XIX.—RAT KILLED BY LEAD-POISONING.

When going into an empty room in my bungalow here three or four days ago, my nose was assailed with that smell which indicates the vicinity of decaying animal matter. I found a dead rat and lying close beside it the small cartridge (saloon or miniature rifle) which I send herewith. I conclude the rodent gnawed the bullet and died from lead-poisoning.

A. C. YATE, LT.-COL.,
2nd Baluch Battn.

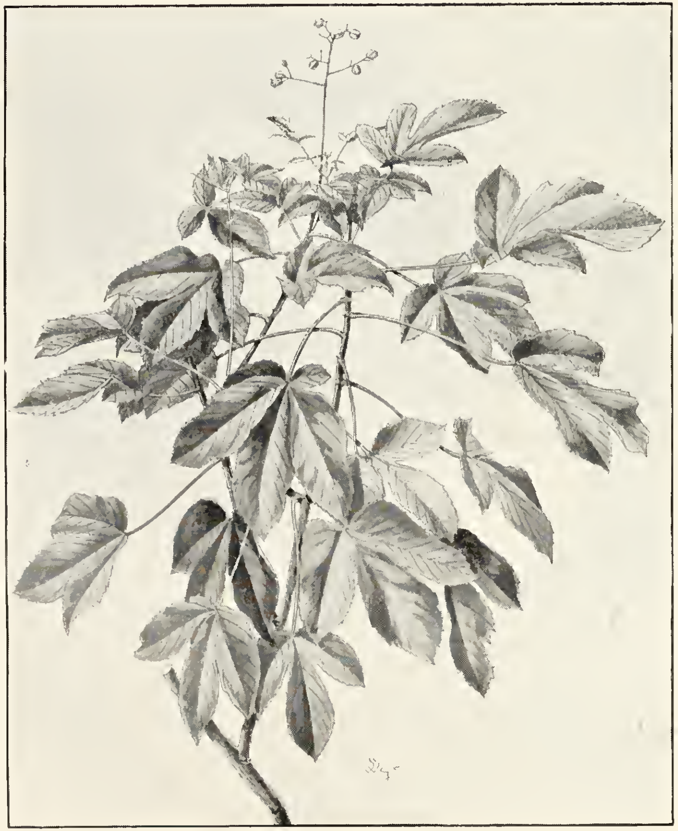
KARACHI, 31*st July,* 1903.

[The bullet shows plainly the marks of a rodent's teeth, and the rat was probably attracted by the grease on the bullet.—ED.]

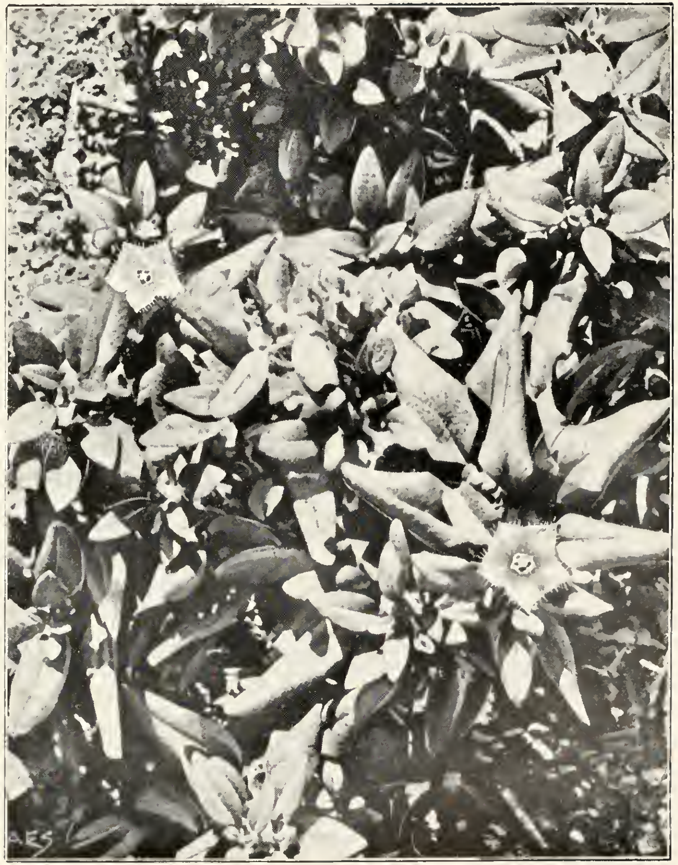
No. XX.—THE FOOD AND POISON OF CENTIPEDES.

Mr. Okeden's notes on the "Centipede eating a Snake" published in the last number of the Society's Journal, has suggested to me that the following notes may be of interest:—

I was disturbed one night by the noise of a sparrow in distress, and thinking that a snake had probably got hold of it, I pulled down the nest which was in the roof of my verandah, and found a large centipede clinging round the sparrow's body with its head buried in the bird's side. The centipede would not or could not let go its hold, and was cut away with a pair of scissors.



Jatropha glandulifera, *Roxb.* Vern. *Underbibi.*



Frerea indica, *Dalz.*

The sparrow had a hole in its side about half an inch in width and the same in depth, and was quite dead and fell to the ground when I pulled the nest down.

On another occasion I placed a large centipede in a glass-covered box with a medium-sized snake *(Zamenis ventrimaculatus)*, and then irritated them with a stick through a small hole in the box, when the centipede attacked the snake and bit it about the centre of its body. The snake kept turning over and over apparently in great pain and in about half an hour died. The centipede was only seen to bite the snake once. Unfortunately neither of the centipedes above referred to were identified.

W. D. CUMMING.

ORMARA, PERSIAN GULF, *July*, 1903.

No. XXI.—*JATROPHA CURCAS.*

With reference to the paper on this plant by my old friend Colonel Kirtikar, I.M.S., I can contribute two more cases of the seeds having been eaten with contrary results. In the first case I was taking an evening walk with a native doctor, and seeing that the Jatropha bushes were full of seed asked him if they were good to eat. He said that children sometimes ate them. Thereupon I ate several, liked them much, and suffered no effects whatever. In the second case I was taking another evening walk with a now eminent Civilian, and telling him of my first experience: we both ate, one seed and two, respectively. The result was a burning in the throat, diarrhœa, general discomfort and depression, that lasted for nigh a week.

The only explanation I can offer is that in the first case the seeds were old and had hung on the tree for months, while in the second case they were barely ripe. The first case occurred at Mandvi (Surat district) in winter, the second at Surat itself in the rains.

F. GLEADOW.

MAURITIUS, 23*rd July*, 1903.

No. XXII.—PARASITES IN PEREGRINE FALCONS.

I have lately had the misfortune to lose within 10 days all those of my peregrine falcons which I was keeping with me in the plains this hot weather from the same cause. I am sending by post three little bottles containing the worms which were the cause of death of the three hawks. Perhaps it may be possible to identify the worm which I have never heard of before as attacking peregrines, and it would be interesting to know whether the parasite is a water-born creature or whether the hawks were infected by the flesh of other birds. Two of the falcons were trained birds, which have been in this part of Rajputana for a whole year, and have therefore been subjected to the same causes of disease; but, curiously enough, one of the hawks was a freshly caught wild bird, which only reached me from Rawalpindi on the 15th of May, and although it appeared fit when caught, it was already sickening when it arrived here. My own hawks began to sicken on the 1st and 5th May, respectively, and I was forced to destroy them on the 22nd and 30th, respectively. The wild hawk arrived here sick on 15th, and had to be destroyed on the 25th. It looks rather like an epidemic disease affecting peregrine falcons this hot season. All the hawks were simply devoured alive by the worms, the lungs, liver, and all the other organs being perforated, and when examined it appeared extraordinary that the hawks should have been able to live at all and feed with their organs in the mangled state they were found in. My own two trained hawks ate voraciously till the end, while the wild hawk refused food for several days; but they all became paralysed in the legs in precisely the same manner, and of course directly this set in I had to destroy them. I have here also a Laggar and two Shikras which are being fed on the same food and water, but none of these have been affected. I should be very grateful if any members could enlighten me as to the nature of this disease; and it would be interesting to know whether any others have observed it, and especially as an epidemic among falcons or other hawks.

S. DELME RADCLIFFE, CAPT.
(Meywar Bhil Corps).

KOTRA, RAJPUTANA, *June*, 1903.

No. XXIII.—DIOSCOREA DÆMONA, ROXB.

This is a common climber in the Thana district, known under the name of Waz by the agriculturalists and wild tribes. It is described in the *Flora of British India* as follows :—

"*Root* tuberous, lobed, biennial. *Stem* stout, terete, more or less prickly. "*Leaves* 3-foliolate, long-petioled; leaflets 3-12 in., glabrous or finely pubescent "beneath, all petiolulate, broadly cuneate-obovate, cuspidately caudate-"acuminate, sometimes strongly reticulate, lateral very oblique 5-6 nerved, "central 3-5 nerved; petiole 6-12 in., smooth or prickly. *Male racemes* 6-18 "in., pubescent or woolly; spikes $\frac{1}{4}$-$\frac{1}{2}$ in., shortly peduncled, cylindric, dense-"fld.; bracts shorter than the flowers; sepals orbicular-ovate, membranous, "shorter than the coriaceous incurved petals; anthers subsessile. *Fem. spikes* "solitary, flowers distant, perianth of the male. *Capsule* 2-2$\frac{1}{2}$ by 1-1$\frac{1}{4}$ in. "base and top truncately rounded. *Seeds* with the oblong wing broader than "the nucleus."

DISTRIBUTION.

It is found in the Tropical forests through India, Burma, and the Malay Peninsula.

Distributed—Malay Islands and Tonkin. In Thana it exists in every forest up to an altitude of 2,000 to 2,100 feet, but it may easily escape notice for in the dry season the stem and leaves die and often only the dried seeds may be observed hanging over the leafless crown of some tree or bamboo clump. It is in the month of May that *Dioscorea daemona* commences vegetative activity by throwing up a green shoot, and it bursts into leaf when the rains set in. The flowers appear in August and are yellowish-green in colour.

It possesses a climbing habit like most of the other Dioscoreas and is therefore usually found growing beneath a tree or shrub.

DESCRIPTION OF TUBERS.

The tubers are ashy grey in colour and varied in shape, some being oval, others conical about 1 to 3 in diameter and weighing each about 6 to 12 oz. or 1 lb. They are found usually about 6″ to 9″ from the surface in loose rocky soil growing in clusters like potatoes. A tuber planted in June attains full development of its stem in about 6 weeks and the leaves remain green till about October, when the stem as already stated withers and dries up. It climbs specially up the bole of a tree to a height of about 12 to 13 feet. Flowering often does not take place when the tuber is planted in soft good garden soil. The Kathodis who are the wood-cutters and charcoal-burners of the Thana district are the chief consumers of the tubers which are largely utilized in seasons of distress. In ordinary years Karva Kand (*Dioscorea bulbifera*) and Londi (*Dioscorea pentaphylla*) tubers are more extensively resorted to.

MODE OF PREPARATION FOR FOOD.

The tubers are immersed in running water all night, removed in the morning, then boiled, peeled and eaten. If not immersed in water but boiled only they produce intoxicating effects, a condition which is described by the local people as "Maz."

CHEMICAL ANALYSIS.

Through the courtesy of Mr. Burkill, Reporter on Economic Products to the Government of India, the tubers were submitted to chemical analysis and afforded the following constituents :—

Water	65·00
Fat	·43
Alluminoides	3·12
Carbohydrates	27·63
Fibre	1·42
Ash	2·40
	100·00

For the sake of comparing the dietetic value of these tubers with that of the potato, the following results of the analysis of this well-known food is reproduced from the Journal of the Department of Agriculture, Western Australia :—

Water	78·3	
Protein	2·2	Nitrogenous matter.
Fat	0·1	
Carbohydrates	18·4	Principally starch.
Mineral matter	1·0	
	100·0	

The above figures, like others for composition of food-materials, represent general averages, from which there are wide variations in individual specimens.

G. M. RYAN, I.F.S., F.L.S.

BANDRA, near BOMBAY, *5th October* 1903.

PROCEEDINGS

OF THE MEETING HELD ON 23RD JULY, 1903.

A meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on 23rd July, 1903, Mr. James Macdonald presiding.

NEW MEMBERS.

The election of the following forty-two new members was announced :—

Life Member—Capt. T. M. Foulkes, I.M.S. (Waltair). Members—H. E. Lady Northcote (Poona); Lieut. A. E. Powell, R. E. (Kirkee); Capt. A. H. Morris, R.A.M.C. (Bombay); Mr. Chas. W. White, F.R.G.S. (Bombay); Sergeant-Instructor Alex. Steel (Bolarum); Capt. C. R. Kelly, R.G.A. (Roorkee); Lieut. W. S. Patton, I.M.S. (Bombay); Capt. A. H. Ollivant, R. A. (Jutogh, near Simla); Col. H. Hodgkinson (Bombay); Mr. H. B. Holme (Bassein, Burma); Capt. C. R. Pearce, I.M.S. (Maymyo, Burma); Capt. A. Mears, I.A. (Bombay); Mr. F. W. Strong, I.C.S. (Jorhat, Assam); Major F. A. Hoghton (Bellary); Mr. A. L. Hine-Haycock (Colombo, Ceylon); Hon'ble Mr. W. R. deCourcy (Ahmednagar); Mr. T. M. Jones (Rangoon); Mr. A. Steheiin (Falam, Chin Hills); Mr. H. King Robinson (Darjeeling); Mr. C. J. Davidson (Bangkok, Siam); Mr. J. Monteath, I.C.S. (Dharwar); Lieut. S. Pershouse (Meiktila, Burma); Lieut. E. M. Bosanquet, R.A. (Quetta); Mr. H. A. Thornton, I.C.S. (Rangoon); Mr. H. Maxwell Lefroy (Surat); Mr. W. C. Symes (Bombay); Mr. C. H. T. Whitehead (Wellington); Mr. M. L. Oakes (Gonda, U. P.); Mr. C. H. B. Kendall, I.C.S. (Gonda, U. P.); Mr. G. C. Verrieres (Fyzabad); Mr. E. B. Howell (Nanking, China); Mr. C. V. N. Shortland (Jubbulpore); Mr. L. Robertson, I.C.S. (Ahmedabad); the Hon'ble A. E. Hill-Trevor (Bombay); Mr. W. Aitchison, I.F.S. (Waltair); Mr. F. E. Coningham (Parvatipur); Mr. L. B. Stephens (Karachi); Major F. C. Muspratt (Shan-hai-kwan, N. China); Mr. R. G. McKerron, M.A., I.C.S. (Rangoon); Mr. Raymond W. Cooper (Karachi); and Mr. Colin Mackenzie (Ootacamund).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting :—

Contribution.	Description.	Contributor.
A number of birds' skins from Chitral.	......	Capt. H. Fulton.
1 Jungle Cat......................	*Felis chaus*	Do.
1 Waved Cat......................	*Felis torquata*	Do.
1 Tiger Cub (fœtal specimen).	*Felis tigris*	Capt. Goring Jones.
1 Dhaman, juv (alive)	*Zamenis mucosus*	Mr. P. Gerhardt.
Some butterflies from Lower Burma.	... ..	Mr. E. McDougall.
2 Skins of White-tailed Bush Chat.	*Pratincola leucura*..........	Mr. S. L. Whymper.
1 Skin of the Redcapped Babbler.	*Timelia pileata*	Mr. S. L. Whymper.
1 Snake (alive)...	*Oligodon subgriseus*	Rev. F. Dreckmann, S.J.

Contribution.	Description.	Contributor.
1 Pheasant-tailed Jacana (alive).	*Hydrophasianus chirurgus.*	Mr. J. Brand.
41 Skins of birds from S. India.	......	Mr. H. S. Ferguson, F.Z.S.
1 White-throated Ground Thrush (alive).	*Geocichla cyanonotus*........	Mr. J. Brand.
1 King Cobra or Hamadryad (alive).	*Naia bungarus*..................	Mr. Norman Davidson.
1 Skin of the Tanrec from Mauritius.	*Centetes ecandatus*	Mr. F. Gleadow, I.F.S.
1 Skull of the Indian Chevrotain or Mouse Deer.	*Cragulus meminna*	Capt. C. D. Lester.
1 Crow's nest made of wire.	*Corvus splendens*	Mr. E. H. Elsworthy.
1 Head of Schomburgk's Deer.	*Cervus schomburgki*	Mr. C. J. Davidson.
Some fossils from the Godaveri river.	......	Mr. H. F. Beale.
1 Skin and Skull of the Golden Cat.	*Felis temmincki*	Mr. L. O. Clarke, I.C.S.
1 Snake	*Dipsas trigonata*...	Mr. A. Vlasto.
2 Skins of Scully's Wood Owl.	*Syrnium biddulphi*	Col. A. E. Ward.
2 Slender Loris (alive).......	*Loris gracilis*	Mr. J. Rodgers.
1 Nest of the Malabar Whistling Thrush.	*Myophoneus horsfieldi*.........	Capt. C. D. Lester.
1 Skin of Argus pheasant (female).	*Argus argusianus*	Mr. A. Neubronner.
1 Head of Arabian Thar ...	*Hemitragus Jayakari*.........	Maj. P. Z. Cox, F Z.S.
1 Skin of Bonnelli's Eagle...	*Hieraetus faciatus*	Mr. H. Vernon Purkis.
2 Skins of Kestrels	*Tinnunculus alaudarius*......	Do.
2 Skins of Cheer Pheasants..	*Catrens wallichi*...............	Do.
4 Skins of Koklas Pheasants	*Pucrasia macrolopha*.........	Do.
2 Skins of Monal Pheasants.	*Lophophorus refulgens*	Do.
2 Skins of Chukor Partridges.	*Caccabis chucar*...............	Do.
1 Skin of Common Teal	*Nettium crecca*	Do.
1 Skin of Western Horned Pheasant.	*Tragopan melanocephalus*...	Do.
1 Skin of Peregrine Falcon..	*Falco peregrinus*..............	Do.
1 Viper	*Ancistrodon himalayanus*....	Mr. S. L. Whymper.
1 Night Heron (alive)*	*Nycticorax griseus*	F. G. Hutchinson.
1 Golden Tree Snake	*Crysopelea ornata*	Mr. G. Oakes.
1 Langur or Hanuman Monkey (alive)*	*Semnopithecus entellus*	Mr. G. M. Prichard.
1 Snake (Chitral)...............	......	Capt R. L. Kennion, F.Z.S.
3 Skins of the large red Flying Squirrel.	*Pteromys inornatus*	Col. A. E. Ward.
1 Egg of the Mallard	*Anas boscas*	Do.

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* Forwarded to the Victoria Gardens.

Minor contributions from Lieut. A. Willock, R.I.M., Lieut. W. S. Patton, I.M.S., Major G. S. Rodon, Capt. J. W. Watson, I M.S., Commander N. Jarvis Wilson, R.I.M., Mr. H. Godwin Austin, Mrs. DuBoulay, Colonel R. Light, Mr. E. C. Cholmondeley, and Mr. K. Ringger.

CONTRIBUTIONS TO THE LIBRARY.

Smithsonian Institution Annual Report for 1901	In Exchange.
Proceedings of the United States National Museum, Vols. 23 and 24...	Do.
Bulletin of the United States National Museum, Nos. 50 and 51..... ...	Do.

Proceedings and Transactions of the Nova Scotian Institute of Science, Vol. X, Part 3	In Exchange.
Directions for Collecting and Rearing Dragon Flies (Smithsonian Institution)	Do.
Directions for preparing study specimens of small mammals	Do.
Directions for collecting Minerals	Do.
Directions for collecting Rocks and for the preparation of thin Sections	Do.
Viertelijahrsschrift der Naturforschenden Gesellschaft in Zurich	Do.
Land and Fresh-water Mollusca from Siam, by Dr. W. T Blandford, F.R.S.	Presented by the Author.
Transactions of the Entomological Society of London, 1902	In Exchange.
Spolia Zeilanica, Vol. I, Part 1	The Colombo Museum.
A List of the Birds of Lucknow, Part I to IV, by Wm. Jesse, M.A., F.Z.S., M.B.O.U.	The Author.
Records of the Botanical Survey of India, Vol. II., No. 4	In Exchange.
Moore's "Lepidoptera Indica," Parts LXI, LXII, and LXIII	Presented by H. H. the Maharaja of Mysore.
Studies in relation to Malaria No. 2. The Structure and Biology of Anopheles, by G. F. Nuttall and A. E. Shipley	The Author.
"Animals of No Importance," by D. Dewar	Do.
Serum reaction of "Bacillus Pestis" in Plague	Do.
Further observations on the reaction of Bacillus Pestis in Plague	Do.
Enteric Lesions inducted artificially by intoxication with the products of Bacillus coli communis and its allies in rabbits and rats	Do.
On a nutrient fluid suited for perfusion experiments of the heart of Rana Tigrina and other allied species in India	Do.
On some effects of the constituents of Ringer's circulating fluid on skeletal muscular contractions in Rana hexadactyla and R. Tigrina	Do.
Precipitation in Plague sera by Dr. R. Row, M.D. (London), B.Sc. (London)	Do.

EXHIBITS.

The attention of members present was drawn to the splendid specimen of an Hamadryad now alive in the Museum. This dangerous snake was captured in the Travancore jungles by a member (Mr. Norman Davidson) who forwarded it to the Society. Another notable contribution exhibited was the head of the Arabian Thar (*Hemitragus Jayakari*) presented by Major P. Z. Cox, F.Z.S., of Muscat. This goat was discovered some ten years ago by a member of the Society, Colonel A. S. Jayakar, after whom it was named, and the head now exhibited is one of the few specimens which have been obtained. Mr. F. Gleadow, I.F.S., also exhibited the skin of a curious animal peculiar to the Island of Mauritius, called the Tanrec or Teurac (*Centetes ecaudatus*). These insectivorous animals are almost tailless. Their food consists principally of earthworms, slugs, snails, etc. They burrow in the soil and are most evident in the warm season. They are greatly prized as food by the Malay Creoles who organize poaching parties to catch them on moonlight nights digging them up out of their holes.

PAPERS READ.

Papers on the following subjects were read :—Kills by Carnivorous Animals, by W. A. Wallinger, I.F.S.; Notes on Anopheles in Ceylon, by Major N. Manders, R.A.M.C., F.E.S.; The Trees and Shrubs of the Lonaula and Karla Groves, by Prof. G. A. Gammie, F.L.S.; The Enemies of Butterflies, by Major C. G. Nurse, F.E.S.; and Curious accident to a Kingfisher, by E. C. Cholmondeley.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 24TH SEPTEMBER 1903.

A meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 24th September 1903 ; Mr. R. C. Wroughton presiding.

NEW MEMBERS.

The Honorary Secretary, Mr. W. S. Millard, mentioned that during this year 142 new members had joined the Society, but more were still required, and it was hoped that members would still continue to try and induce others to join.

The election of the following new members was announced :—Mr. T. Malcolm (Behrampur); Capt. E. A. Fagan (Alwar); Mr. R. H. Brooke (Bombay); Mr. F. Sikes (Badulla, Ceylon); Capt. W. Lethbridge, I.M.S. (Muscat); Mr. G. Wapshare (Ootacamund); Surgeon-General G. W. R. Hay, I M.S. (Ootacamund); Mr. L. K. Martin (Buldana, Berars); Mr. G. B. de Mowbray (Maskeliya, Ceylon); Mr. C. P. Hodgson (Ootacamund); Captain C. Swan (Ootacamund); Sir Frederick Price (Ootacamund); Mr. C. Mullaly, I.C.S. (Ootacamund); Major F. Vans Agnew, R. A. (Wellington, Nilgiris); Captain N. S. Coghill, I.A. (Radhanpore, Gujerat); Mr. J. C. Hopwood (Kyauksee, Upper Burma); Mr. W. S. Burke (Calcutta); Mr. H. P. W. Macnaghten (Bombay); Captain E. G. W. Pratt (Bombay); Captain D. C. Kemp, I.M.S. (Cuddalore, South Arcot, Madras); Mr. J. H. Ivens (Mussoorie); Honorary Secretary, R. A. Mess, Roorkee (Roorkee); Mr. W. A. Hertz (Myitkyina, Upper Burma); Major W. B. Bannerman, I.M.S. (Bombay); Mr. B. V. Kelly (Baumauk, Katha, Upper Burma); Major A. F. Mackenzie, M.V.O. (93rd Highlanders, Calcutta); and Captain E. W. Harris (Vizianagram).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting :—

Contribution.	Description.	Contributor.
1 Snake (alive)	*Tropidonotus platyceps* ...	Mr. H. Vernon Purkis.
1 Skin of the Turkestan Grasshopper-Warbler.	*Locustella straminea* ...	Major A. Newnham.
2 Skins of the Brown Rock-Pipit.	*Anthus similis*	Do.

Contribution.	Description.	Contributor.
1 Skin of the Crested Goshawk.	*Lophospizias trivirgatus*	Mr. C. H. Donald.
1 Skin of the Crested Hawk Eagle.	*Spizætus cirrhatus*	Do.
1 Skin of the Serpent Eagle.	*Spilornis cheela*	Do.
1 Himalayan Viper (alive).	*Ancistrodon himalayanus*	Mr. H. Vernon Purkis.
A small collection of Minerals from the C. P.	......	Mr. G. M. Prichard.
2 Skins of the Himalayan Mouse-Hare.*	*Lagomys roylei*	Col. A. E. Ward.
3 Skins of the Kashmir Vole.*	*Microtus brachelix*	Do.
2 Skins of the Brown Rat	*Mus decumanus*	Do.
1 Egg of the Magpie	*Pica rustica*	Do.
1 Bustard Quail (alive)	*Turnix pugnax*	Mr. J. Brand.
1 Sea Snake	*Distira robusta*	Mr. R. A. Spence.
1 Snake	*Zamenis ravergieri*	Capt. R. L. Kennion, F.Z.S.
1 Nest and Eggs of the White-cheeked Bulbul.	*Molpastes leucogenys*	Mr. E. W. Harper, F.Z.S.
2 Snakes	......	Lieut. W. S. Patton, I.M.S.
2 Scorpions and 1 Millipede from Aden Hinterland.	......	Do. do.
2 Curlews (alive)	*Numenius arquata*	Mr. F. G. Hutchinson.
1 Lizard (alive)*	*Charasia dorsalis*	Col. A. C. Daniel, R.A.
1 Young Crocodile (alive).	*Crocodilus palustris*	Mr. J. T. Rodgers.
3 Snakes	*Dipsas trigonata*	Mr. W. W. Coen.
1 Snake	*Tropidonotus stolatus*	Do.
1 Tortoise	......	Mr. G. P. Millett, I.F.S.
Some Butterflies from Vizagapatam District.	......	Mr. H. R. G. Hasted.
1 Leopard Cat (alive)	*Felis bengalensis*	Do.
1 Snake (alive)	*Cerberus rynchops*	Mr. C. F. Spencer.
1 Snake	*Tropidonotus piscator*	Col. R. Light.

* New to the Society's collection.

Minor contributions from Mr. C. Fischer, Mr. S. D. Navalkar, Captain Corbett, Colonel R. Light, Mr. Narotumdas Morarji Goculdas, Mr. E. C. Cholmondeley, Mr. M. R. Jardine, Mr. G. W. Moir, Mrs. DuBoulay, Mr. A. B. Simkins, and Mr. C. Rustomji Avari.

CONTRIBUTIONS TO THE LIBRARY.

Bulletin de la Société Zoologique de France, Annee 1902, in exchange.

Departmental Notes on Insects that affect Forestry, by E. P. Stebbing, F.L.S., F.E.S., F.Z.S., presented by the Author.

Illustrations of the Zoology of the R.I.M.S. "Investigator," Crustacea, Part X, in exchange.

Lepidoptera Indica, Moore, Part LXIV., H. H. the Maharaja of Mysore.

Peripatus, Myriapods and Insects, Part I (Cambridge Natural History Series), presented by Mr. E. Comber.

THE JOURNAL.

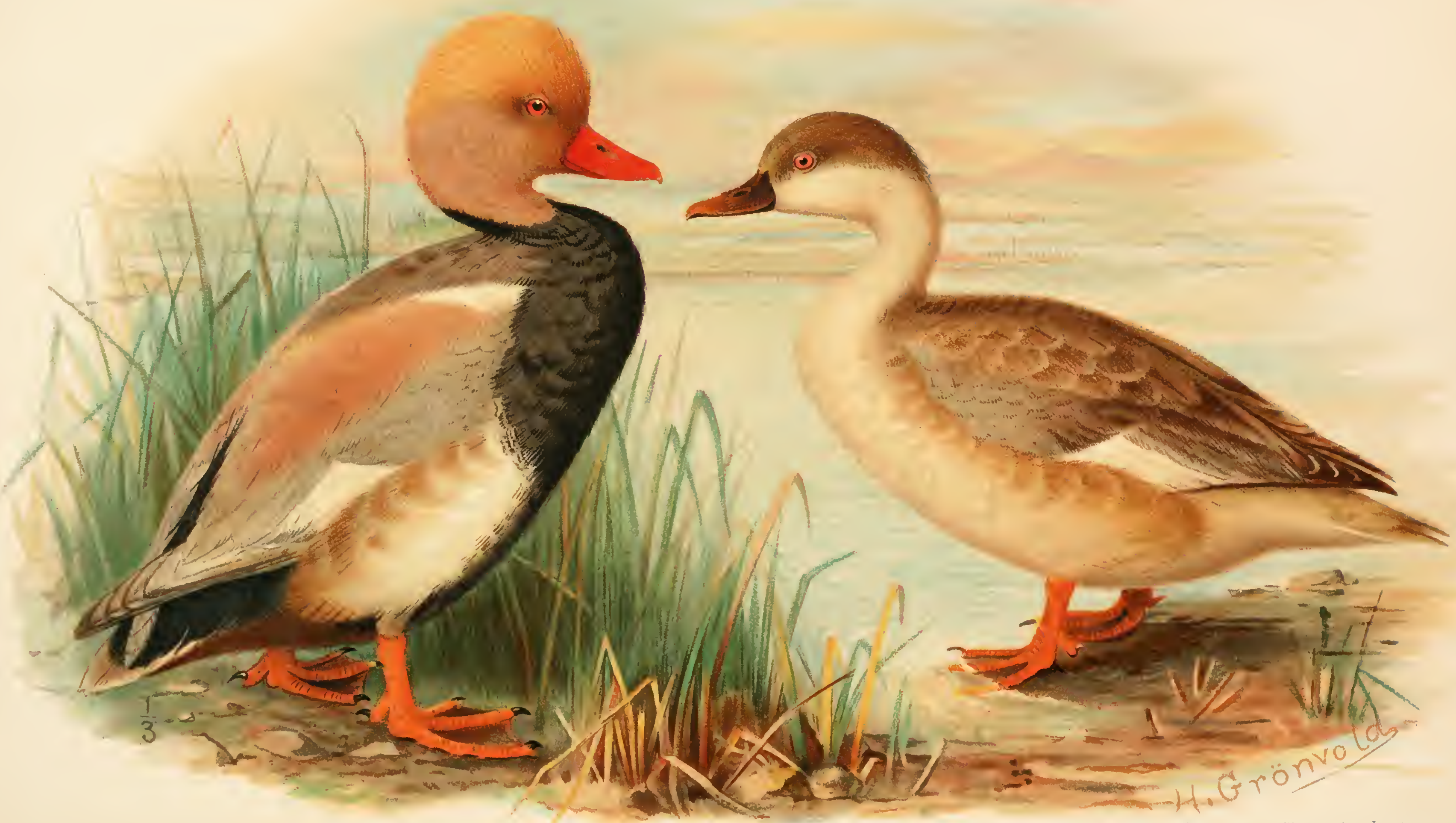
The Honorary Secretary mentioned that the Committee were glad to announce that a very valuable series on the "Snakes of India" (with coloured illustrations), written by Captain F. Wall, I.M.S., would shortly commence in the Journal, and the plates were now being prepared at home. They also had in view a series on the "Common Butterflies of India," by which the butterflies of the plains were referred to. This series would also have coloured illustrations, and, as Mr. E. H. Aitken had kindly promised to write some of the letter-press, it would be certain to be interesting and as attractive as all his writings are.

PAPERS READ.

The following papers were then read :—1. "The Food and poison of Centipedes," by W. D. Cumming. 2. "Notes on the nidification of the Indian Rain Quail," by R. H. Heath. 3. "Curious accident to the Common Swift, by M. D. Mackenzie. 4. On the Collections in the Society's Museum, by E. Comber.

Mr. Comber said the purposes for which museums are established, may be divided into two heads, *viz.*, the diffusion of instruction and amusement among the mass of the people and to afford the opportunity for scientific research, under which latter head the Society's museum of course falls. He then pointed out the danger of museums and the collections they contain being allowed to deteriorate into the condition of a mere accumulation of rubbish, unless they are properly taken care of, arranged, and catalogued. In laying stress upon these points he mainly relied upon quotations from the words of the late Sir William Flower who was for many years in charge of the British Museum (Natural History), and who had a larger experience of the management and arrangement of museums than any one else in the whole world. Mr. Comber pointed out that the very life of a museum depended on its Curator, which in the case of a Society such as this was a work that had to be divided amongst a number of its members, since the Society was not in a position to employ a properly qualified and salaried official. More than half of its funds were expended on the publication of its Journal, through which alone it was possible to bring the work of the Society before its members, scattered as they are over nearly the whole world. He then referred to the already vast amount of work that fell upon the Honorary Secretaries, and appealed to members, resident in Bombay, to come forward and give a helping hand to the Society's museum by taking some department under their special charge, as has been the system in years past. Through one circumstance or another the Society has lately lost, or is losing, the assistance of several of its most enthusiastic resident members, such as Mr. E. H. Aitken and Mr. R. C. Wroughton, and unless others—even if less experienced—will come forward, the work of the Society must inevitably suffer. The Society has up to now not succeeded in filling the vacancies caused by the departure of Captain A. J. Peile, R.A., and Staff Surgeon Bassett-Smith, R. N., who so ably controlled the departments under their care. Mr. Comber then briefly reviewed the collections in the museum, pointing out where they were weak and required a helping hand to bring them into order, so that they may be of the greatest use to the members. Without this being done, much really valuable material was lying waste, never being brought before the world of science. He ended with a further appeal to those present to use their influence with other members to come forward and give a helping hand.

The meeting then ended with a vote of thanks to the authors of the papers.


1/3
H. Grönvold

H Gronvold del.

Mintern Bros. Chromo lith. London

THE RED-CRESTED POCHARD.

Netta rufina

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XV. BOMBAY. No. 3.

INSECT LIFE IN INDIA AND HOW TO STUDY IT,

BEING

A SIMPLE ACCOUNT OF THE MORE IMPORTANT FAMILIES OF INSECTS, WITH EXAMPLES OF THE DAMAGE THEY DO TO CROPS, TEA, COFFEE AND INDIGO CONCERNS, FRUIT, AND FOREST TREES IN INDIA

BY

E. P. STEBBING, F.L.S., F.E.S.

PART II.

(*Continued from page 192 of this Volume.*)

Chapter IV.

Order III. Neuroptera.

In this Order the adult Insect is provided with a biting mouth. Two pairs of wings are present, usually furnished with an extensive system of nervures or veins which form a network in the wing. The metamorphosis is incomplete. Some of the members of the Order are wingless. Fig. 23 shows a common dragon-fly which is a good representative of this Order.

The Neuroptera comprise a comparatively small number of insects, including the Termites or the so-called 'white ants,' dragon-flies, stoneflies, May-flies, caddis-flies, lace-wing flies, ant-lions, &c., and the wingless bird-lice.

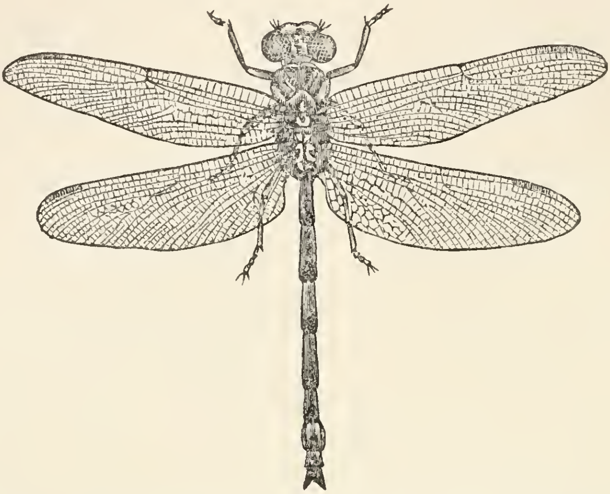


FIG. 23—A Common dragon-fly. *Tetinus rapax* (Calcutta). ⅔rds nat. size.

Present knowledge and observations on these insects tend to show that with the exception of the termites they are not of great importance as pests. For our purpose it will be sufficient to consider shortly six families, a seventh, the *Termitidæ*, being dealt with in somewhat greater detail.

Fam. I. Mallophaga.—Bird-Lice or Biting Lice.

These are flat wingless insects furnished with a large head ; thorax usually of two, rarely of one or three segments ; prothorax always distinct, hind body consisting of 8 to 10 segments in addition to the two posterior thoracic segments. The whole of the insects of this family live a parasitic life, creeping about on those parts that are near the skin, the feathers or the hair of birds and mammals. They rarely come near the surface, so that they are not detected on a superficial examination. The legs are specially adapted for climbing amongst hair and feathers, as the last joint of the foot is hook-shaped and can be bent back against the preceding joint ; a hair can thus be held fast between the two joints. The eggs are fastened by the mother louse to the hairs, etc., of the host. These insects either suck the blood of the host or eat the fir or feathers. Lice multiply very rapidly on the bodies of human beings and animals when insufficiently cleansed, and under these circumstances more on sick and ill-nourished individuals than on healthy and well-nourished ones.

In Fig. 24*a*, is shown the dog-louse, *Trichodectus latus* with one claw to the foot, and in *b*, the common fowl-louse, *Menopon pallidum* (greatly enlarged) with two claws to the foot as is usual with the bird lice. This latter species multiplies rapidly and passes readily from one fowl to another, and so may become a pest in the fowl house.

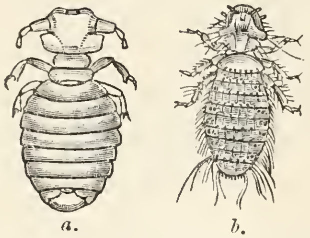


FIG. 24.—A, Common dog-louse *Trichodectus latus.* B, Common fowl-louse *Menopon pallumid.*

Remedies.—The frequent dust baths fowls are so fond of indulging in are believed to be a remedy against the chicken louse.

Suitable feeding and treatment and proper care of the skin are preventatives. Repeated combing with a comb which has been dipped into a solution of soda or rubbing the badly infested spots with soft soap and soda, washing them out after 24 hours, are cures, and will be found useful in the case of infected ponies or other livestock.

Fam. II. Termitidæ—White Ants, Termites.

The members of this family of insects live in colonies similar to the mode of existence obtainable amongst the true Ants and the Bees. The Termitidæ, however, have no characters in common with these latter save a similar mode of existence, and the term 'White Ant' is, though a popular name for these insects, a misnomer, and its use is to be deprecated.

Each species of Termite is social, and consists of winged and wingless individuals. The four wings are, in repose, laid flat on the back, so that the upper one only is seen, except at the tips; they are membranous and very long, extending for some distance beyond the extremity of the body; the hind pair are similar in size and consistency to the front pair. Near the base of each wing there is a suture or line of weakness, along which the wings can be broken off, the stumps thus remaining as short horny flaps on the back. The neuration is unlike that of other insects. It is very simple, consisting of two longitudinal nervures enclosing a space between them, like the mid-rib of a leaf. Smaller transverse veins take off on either side of them. The whole resembles a feather of a bird or a much veined leaflet. Wingless individuals are very numerous in the colony, and have the head and thirteen body segments distinct, the body being terminated by a pair of short cerci.

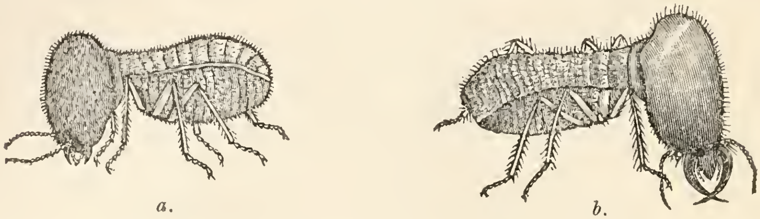
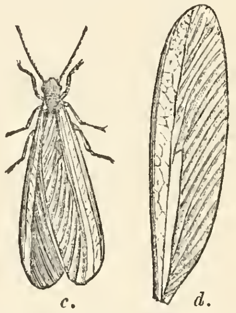
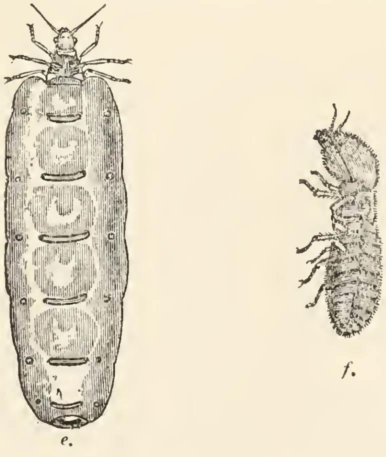


FIG. 25.—Common White Ant or Termite. *Termes taprobanes* (India) *a*, worker; *b*, soldier; *c*, winged male; *d*, wing of male (enlarged 1½ times): *e*, female or Queen Ant after pairing, showing enormously swollen body containing the eggs; *f*, a larva (*a*, *b*, & *f*, greatly enlarged).

The integument is delicate and the chitinous plates are never very hard, at times being so slightly developed that the Insect appears to consist of a single membranous sac with creases in it, the head alone being distinct. The head is exerted and frequently of large size, sometimes nearly as large as all the rest of the body together (See Fig. 25*b*.) Termites may be quite blind or may possess simple and compound eyes. The antennæ are moniliform, and short, and the legs are like one another.





The following is the life history of the Termite or common 'White Ant,' *Termes taprobanes*, of India:—

The insect lives in communities consisting of an enormous number of individuals. The adult forms found in a community are (1) workers, (2) soldiers, (3) winged males and females, (4) some of these winged forms which have lost their wings. (See Fig. 25 *a*—*f*.) In addition there are the young larvæ. The winged king and queen are only present for a few days. The individuals which have lost their wings are usually limited to one pair, the king and queen. These two may be recognized by the stumps of their cast wings, which are to be seen as small appendages on the dorsal surface of the thorax. The continuance of the nest is effected entirely by the king and queen. They are generally incapable of leaving the nest, more especially the queen, whose body swells up enormously after fertilisation to many times its original bulk. Great disorganisation occurs in the colony if anything happens to the royal pair, and in consequence of this certain individuals amongst the larvæ are kept in such a state that they can be quickly converted into royalties should it become necessary. It thus becomes obvious that the old theory that it was possible to get rid of a 'white ant' nest by digging out and killing the king and queen is quite untenable. When this is done, or when anything happens to the royal pair, the termites left in the nest simply set about preparing a substitute royal couple. The soldiers may be distinguished by their very large heads and powerful mandibles. Their work is to guard the colony against enemies. The workers build the nest and look after the young larvæ. The males and females are produced in enormous numbers, and may often be seen at the commencement of and during the rains issuing from the nest in great clouds, either from the big earthen erections or stumps of trees in the field and forest, or from the base of walls, plinths, etc., of houses. On reaching the outside they proceed in a continuous stream upwards, and these great flights never fail to attract all the kites, crows, minas and other insectivorous birds in the neighbourhood, who stuff themselves to repletion with the food so easily obtainable. After this nuptial flight and their return to earth, those termites which escape their numerous enemies in the air, tear off their wings, these latter parting at the sutures described above, and pair, should the pairing not have been gone through in the air. The now wingless insects then endeavour to find their way back to the original nest, and a few succeed, the greater proportion however being either killed off or dying in the attempt. It is to ensure the survival of the few that in all probability such enormous numbers of the winged individuals are provided. After return to the nest the body of the queen begins to swell up by a distension of the membrane between the chitinous plates, until it becomes like a sausage 2—3 inches in length, with the minute head and thorax at the top. (See fig. 24*e*.) She then lays a number of eggs daily, continuing this performance for a long period of time.

Termites never expose themselves willingly to daylight (except the king and queen during the nuptial flight) and consequently the workers make galleries to move about in. For their nests they build mounds of different shapes and sizes, these being sometimes several feet high. Such mounds are to be seen commonly over the whole of the warmer parts of India. They are formed of particles of earth worked up into a material which dries as hard as stone. Their nests are also made in the interior of trees, the wood being gnawed away and replaced by mud; beams and wooden floors of houses, etc., are also made use of in this way. When attacking a structure, such as a post, the insects always work on the unexposed sides and in the interior, being very careful to leave all the external portions of the wood intact. This habit of theirs occasionally leads to serious accidents, roofs or heavy beams, etc., apparently sound, falling in without a moment's warning owing to their supports having been, unseen, entirely undermined by this pest. In the forest large branches of trees may be seen to occasionally fall in this way, and examination shows that the apparently sound though dead woody branch is but a mass of earth enclosed in the outer shell of rough bark, the entire interior having been removed and replaced by mud, every particle of which has been taken up the tree by earthen galleries running up, if the tree is still alive and healthy, on the outside of the bark.

Termites have also been reported as attacking seedlings of various species of trees, shrubs and crops, eating off the bark and thus killing the plants. An example of the damage they are capable of doing in this way has been recently brought to my notice. In the Lachiwala nursery in the Dehra Dun Division some young rubber plants of as much as 5 ft. in height and quite healthy were attacked by these pests and killed within a few weeks. An examination showed that the lower part of the stem just above the surface of the soil had been surrounded with earth and the bark beneath entirely eaten off two-thirds of the circumference of the stem, whilst in addition the woody interior had been badly riddled. The attack was not noticed until the plants began to bend over and die.

Sugar-cane also at times suffers severely from *T. toprobanes* which burrows into and destroys the sets soon after planting, and eats through the junction between the young plant and the plant set, so that the young plant dies off. Castor cake whilst being a manure, is said to serve as a prevention against these attacks.

In Gujerat the pest is said to attack most crops after they are cut and stored, and hay, corn stacks, &c., must be carefully watched. Corn is always threshed soon after it is cut for fear of this pest.

Termes fatalis König is a termite said by Nietner to occasionally attack coffee bushes in Ceylon but to do little damage to them. The writer discovered another species of white ant boring into fresh sandalwood in the Coimbatore forests in Madras. This *Termes* does not make earthen galleries, but lives and bores in the solid wood. Fig. 26*a* shows a worker and *b*, a soldier of this species.

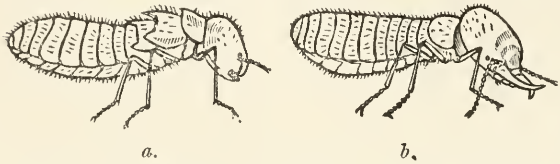


FIG. 26.—Sandalwood white ant. *Termes* sp. (Coimbatore, Madras Presidency) *a*, worker; *b*, soldier, greatly enlarged.

Prevention.—In countries where termites are common, wooden beams and supports of houses should be constantly and carefully inspected and tested to see that they are not being hollowed out or undermined by the pest. Wooden posts used as supports to bungalows should be thickly tarred on the ends placed in the ground, and once a year these ends should be exposed by removing the soil and fresh tar laid on, a small pool of tar being formed round the end in contact with the soil. The wooden parts above soil should be constantly inspected, and all mud galleries running up them be brushed off, as the termites will give up the attack once they are exposed to light.

Remedies.—When the 'white ants' are troublesome in bungalows or nurseries, careful search should be made for their nests, the earthen galleries, under which the insects are doing the damage, being traced back to the point they emanate from. The nest having been found, all save one or two large openings should be closed and some pieces of carbon bisulphide be pushed into the unclosed openings, which should then be sealed up. The fumes will sink down through the nest and entirely exterminate the colony. Care must be taken to (1) close all the openings and (2) not to breathe the vapours given off by the carbon bisulphide.

In houses tar well all stone, earthen or wooden floors, both round the edges and up the walls for a few inches and in the centre before laying down mats, carpets, &c. These latter should be removed for inspection at intervals, depending upon the abundance of the pest in the neighbourhood.

In the case of nursery stock like the above alluded to young rubber saplings and young roadside saplings and poles, the mixture known as 'Gondal Fluid' should be made use of. It is prepared as follows:—1 part *dekamali* gum (this is the resin of *Gardenia gummifera*); 2 parts asafœtida (*hing*); 2 parts bazar aloes (*gugul*); 2 parts castor oil cake: pound these together and mix up thoroughly; then when the mixture is decomposed into a thickened compound, add water till it is of the consistency of paint. Some colouring material such as ochre should be added, so that the material can be seen when put upon the trees. When ready the mixture should be painted upon the trees in a continuous band 2 ft. to. 3 ft. high, starting from the surface level of the soil, care being taken that all interstices in the bark are coated with it. The earthen tunnels of the termites should be first scraped off. All the materials for this mixture can be procured at slight cost in the bazar.

It has been used with great effect.

Fam. III. Psocidæ—Book-Lice, Death-Watches.

Minute insects with slender thread-like antennæ consisting of from 11—25 joints. Prothorax is very small and concealed between the head and the mesothorax. Four delicate membranous wings are present, the upper pair being the larger.

The small insects found amongst dust and books in dry places belong here. They somewhat resemble a miniature termite and are often mistaken for true lice and thus are apt to cause a scare in a house, when they suddenly increase in large numbers. Their food is starch or dry animal and vegetable matters, and this is what leads them to attack the buildings, plates and pages of books.

Napthaline is the best prevention against them. Fig. 26 shows a common book-louse.

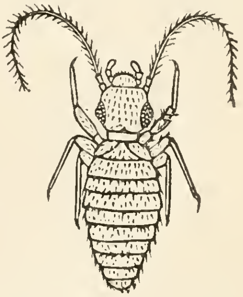


FIG. 27.—A common book-louse.

A small psocid, *Psocus* sp, is extremely plentiful on the leaves of the sal (*Shorea robusta*) tree in the Dun Forests during the latter part of February. Small brown patches of rotten tissue appear on the leaves, but whether these are due to the insect or whether the insect is merely feeding upon a fungus which is causing the discolouration has yet to be determined. The insect is a minute yellow one, both wingless larvæ and winged individuals being present. (See Fig. 28.) The family has up to date only been reported as feeding upon rust fungi, vegetable refuse, etc.

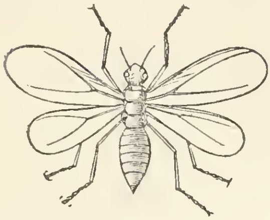


Fig. 28.—Psocus(?)sp. (Debra Dun, North India).

Fam. IV. Odonata Libillulidæ.—Dragon Flies.

Elongate insects with a very mobile head and large eyes, strong mandibles and a broad lip, the antennæ being small, inconspicuous, and ending in a bristle. Wings four in number and elongate, of equal size, and similar texture. All the legs are placed more anteriorly than the wings (See Fig. 29). The earlier stages of their life are spent in water, the larvæ breathing by means of tracheal gills. The metamorphosis is incomplete, but there is a great change in the appearance of the insect at the last moult. The attachment of the head to the thorax is such that it enables the insect to move the former round with great ease. The eyes are often enormous and occupy the greater part of the head. Three ocelli are present.

The family is carnivorous, and the mature insect catches its prey on the wing. The eggs are deposited either in water or on the stems of some aquatic plant. The young on hatching out have no wings and are quite unlike the mature insect. The wings begin to appear at the fourth moult or change of skin. The family is not of importance economically. Fig. 23 shows a large dragonfly, *Tetinus rapax* common in Calcutta and Fig. 29 a graceful emerald green bodied

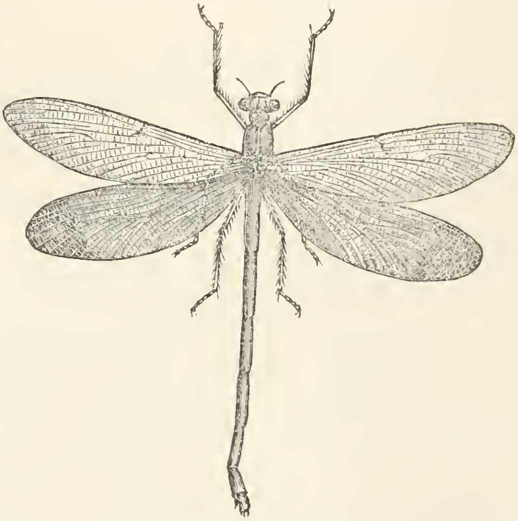


Fig. 29.—The green winged dragon fly. *Neurobasis chinensis.* (Assam.)

dragonfly, *neurobasis chinensis,* the lower wings of which are coloured emerald green shading off into brown.

Fam. V. Ephemeridæ.—May-flies.

Delicate insects with short antennæ, four membranous wings, the hinder pair smaller than the front ones. The adult can be easily distinguished by the possession of two or three very elongate slender tails terminating the end of the body. The earlier stages of the life are passed in water, the larvæ consequently differing greatly from the adult. Fig. 30*a* shows the May-fly *Ephemera remensa* ; whilst *b* shows a much enlarged aquatic larvæ with six pairs of tracheal gills on its sides.

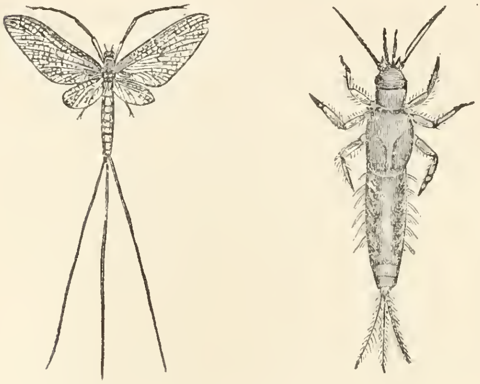


FIG. 30 —The common May-fly *Ephemera remensa* ; *b*, aquatic larva of a May-fly showing the six pairs of aquatic gills.

The May-flies are not of economic importance. The appearance of the adult in English trout streams is eagerly looked for by the keen fisherman, and the insect would appear to be equally abundant and sought after as an article of diet by the fish of some, at any rate, of the Indian rivers and streams. The study and working out of the life-history of the Indian species would not unlikely well repay the ardent fisherman in this country.

Fam. VI. Hemerobiidæ.—Ant Lions, Lacewing Flies, etc.

Insects with a vertical head ; maxillæ free with five-jointed palpi ; the labial palpi three-jointed. Wings equal in size and highly netveined. Tarsus five-jointed. The metamorphosis here is exceptional, being almost complete. The larva has mandibles and maxillæ forming spear-like organs, which are also used for sucking. The insects have in fact a suctional mouth in the earlier stages of their life-history and a biting one in the adult. This is unusual and the reverse of what occurs in the Lepidoptera and other big Orders. The pupa has the general form of the imago, and is enclosed in a cocoon. These insects live on land in all the stages of their existence.

In the Myrmeleonides (ant-lions) the antennæ are short, clubbed and the apical space of the long wings contains regular oblong cellules in it. Fig. 31*a*, shows an adult of *Palpares* sp. *a* common Bengal ant-lion. These insects are interesting owing to the fact that the remarkable habits of the larvæ have been known to naturalists for over two centuries. The larva (shown in Fig. 31*b*) is predacious and secures its prey by constructing traps. For this purpose some sandy spot is chosen, and a funnel-shaped pit hollowed out with the sides as steep as possible. The larva buries itself at the bottom of this, leaving only its elongate jaws projecting out of the sand at the bottom of the pit. The latter being constructed in dry loose sand, an insect running along the ground and reaching the edge slips on the moving sand and falls into the pit, to be impaled on the sharp mandibles of the larva, who then sucks out its body contents. Even should the insect not be impaled upon the mandibles, the ant-lion larva will secure it before it has managed to escape up the shelving slipping sides of the pit. These insects are common in many parts of India, more especially in dry, sandy riverbeds, etc.

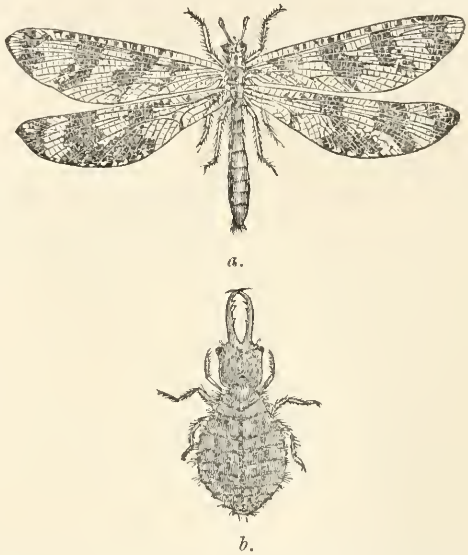


Fig. 31.—A common Indian Ant-lion *Palpares* sp. (Bengal); *b*, larva Ant-lion enlarged twice.

An ant lion *Micromus australis* is said by Nietner to attack the coffee louse (*Aphis coffeæ*) in Ceylon.

The *Chrysopides* (lace-wing flies) are fragile insects with elongate bristle-like antennæ. They have metallic red-coloured eyes, by which they can be recognized. They are of no importance as far as present observation has shown.

Fam. VII. Phryganeidæ.—Caddis-flies.

The wings are more or less clothed with hair; the hind ones are larger than the front which are held in a roof-shaped manner over the body when at rest. Antennæ are thread-like, mandibles are absent. The metamorphosis is nearly complete. The larvæ are caterpillar-like, usually inhabiting cases of their own construction. The pupa resembles the perfect insect.

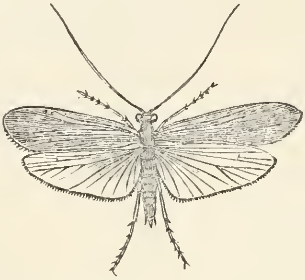


FIG. 32.—An adult Caddis-fly (Sikkhim).

These insects have the appearance of small black moths (*Lepidoptera*) and are to be found in the neighbourhood of water, in which the larval stage is passed. Fig. 32 shows an adult caddis-fly. They are unimportant.

Useful Neuroptera.

The Order cannot be said to contain many insects of use to man. The dragon fly, in its adult condition, and the ant-lion larva are both carnivorous and prey upon insects and both probably do a certain amount of good by catching and feeding upon noxious insect pests. It is not improbable, however, that they also in this way kill off useful insects. The dragon-fly catches its prey entirely upon the wing.

(*To be continued.*)

A LIST OF THE BATRACHIANS KNOWN TO INHABIT THE MALAY PENINSULA, WITH SOME REMARKS ON THEIR HABITS, DISTRIBUTION, &c.

By A. L. BUTLER, F.Z.S., M.B.O.U., &c.

(*Director of Game Preservation, Soudan Government.*)

(*Continued from page 205 of this Volume.*)

Family *Engystomatidæ.*

31. CALOPHRYNUS PLEUROSTIGMA, Tschudi.

Calophrynus pleurostigma, Blgr., Cat. Batr. Sal., p. 158 ; S. Flower, P. Z. S., 1896, p. 908, and P. Z. S., 1899, p. 900.

Mr. Ridley and Mr. Flower appear to be the only naturalists who have obtained this frog in the Peninsula. Mr. Ridley procured it in Selangor in July 1897 and Mr. Flower at the foot of Gunong Palai, Johore, in September of the same year.

Flower remarks that this species is supposed to be the author of a remarkable strident call heard in certain Malay jungles, which may be written " waalk, waalk." I believe however that the note he refers to is one which puzzled me for a long time, but which I recently found to be produced by *Rana hascheana*.

Distribution.—Burma, S. China, Siam, Malay Peninsula, Natunas, Borneo.

32. MICROHYLA ORNATA, Dum. and Bibron.

Microhyla ornata, Boulenger, Cat. Batr. Sal., p. 165 ; *id.* Fauna Ind., Rept., p. 491 ; S. S. Flower, P. Z. S., 1899, p. 901, pl. lx, figs. 1, 1*a*, 1*b* ; Laidlaw, P. Z. S., 1900, p. 887.

Flower collected this little frog in Penang, and from Alor Star and Jenan in the State of Kedah. The Skeat Expedition also procured a single specimen at Kuala Aring in Kelantan. Its distribution in the Peninsula is probably local, as in three years collecting in Perak, Pahang, and Selangor I never came across it.

According to Flower the species is nocturnal in habits, concealing itself during the day under stones, logs, etc., in crevices, and among dead leaves. The same writer describes its croaking as an astonishing volume of sound for so small a creature to produce.

The tadpoles of this and other species of *Microhyla* are very peculiar, being almost perfectly transparent, with the viscera showing through conspicuously. The head, seen from above, is remarkably square, and occupies about two-thirds of the whole body. On the back there is usually a pale yellowish-brown pentagonal or diamond shaped mark. My experience of these tadpoles was much the same as Flower's; at different times I obtained tadpoles of this genus belonging to three or four different species, but owing to their extraordinary delicacy I never managed to keep them alive. As Flower remarks, they pass most of their time just beneath the surface of the water instead of on the bottom.

Distribution.—Kashmir, India, Ceylon, Burma, Southern China, Cambodia, Siam, Malay Peninsula. (Flower.)

33. MICROHYLA INORNATA, Blgr.

Microhyla inornata, Boulenger, P. Z. S., 1890, p. 37 ; S. S. Flower, P. Z. S., 1899, p. 905 ; Laidlaw, P. Z. S., 1900, p. 887.

Three specimens were obtained by the Skeat Expedition on Bukit Goah, near Biserat, in Jalor. Previously recorded from Sumatra, Borneo, Pegu, and Siam.

34. MICROHYLA LEUCOSTIGMA, Blgr.

Microhyla leucostigma, Blgr., A and M. N. H. (7), Vol. III., 1899, p. 275, pl. xii, fig. 1 ; S. Flower, P. Z. S., 1899, p. 905.

Discovered on the Larut Hills, Perak, by Flower in April 1898, three specimens being obtained at 3,500 ft. elevation.

I procured four specimens in April this year from the same locality.

It has also been obtained in Borneo on the Baram River by Mr. C. Hose.

Three of my specimens measure from snout to vent $\frac{9}{10}$, $\frac{19}{20}$, and 1 $\frac{1}{20}$th of an inch. Above black with a bluish gloss, sprinkled throughout with very small bluish white spots. Beneath chequered throughout with an irregular net work of broad blackish brown lines, enclosing large patches of bright yellow.

35. MICROHYLA BUTLERI, Blgr.

Microhyla butleri, Boulenger, Ann. and Mag. Nat. Hist. (7), Vol. VI, Aug. 1900, p. 188.

Described from a single specimen which I obtained on the Larut Hills in April 1900. I found it at the margin of a small pond at 4,000 feet elevation, among a number of *Microhyla annectens*, also at that time a new species.

Description.—Habit slender, snout rounded, as long as the orbit; inter-orbital space broader than the upper eyelid. Fingers and toes rather slender, the tips dilated into small but well-developed disks ; first finger much shorter than second ; toes webbed at the base ; subarticular tubercles small ; two very small metatarsal tubercles. The tibio-tarsal articulation reaches the eye. Skin smooth. Grey on the back, pale reddish on the sides and limbs, with symmetrical dark brown markings forming bars on the limbs ; some small scarlet spots on the sides, a whitish oblique streak from the eye to the base of the fore limb and a whitish spot on the end of the snout ; whitish beneath, throat and breast speckled with dark brown.

" From snout to vent 21 millim.

" Closely allied to *M. achatina*. Distinguished by the shorter limbs."

Type in British Museum.

36. MICROHYLA ACHATINA, Boie.

Microhyla achatina, Boulenger, Cat. Batr. Sal., p. 166 ; S. S. Flower, P. Z. S., 1899, p. 905 ; Laidlaw, P. Z. S., 1900, p. 888.

Has been obtained in the Peninsula from Malacca (Hervey) ; from Penang and Perak (Flower) ; and from Rhaman and Kelantan by the "Skeat Expedition." Flower describes it as "a very active frog, at times taking very sudden long hops like a grasshopper, at others using its dilated digital disks in climbing like a true tree-frog.

Distribution—" Tenasserim, Siam, Malay Peninsula, Sumatra, Java, Malaccas" (Flower).

37. MICROHYLA ANNECTENS, Blgr.

Microhyla annectens, Boulenger, Ann. and Mag. Nat. Hist. (7) Vol. VI., Aug. 1900, p. 188.

I obtained the type specimens of this diminutive frog at the margin of a small pond in jungle on the Larut Hills, at about 4,000 feet elevation. Altogether I got nine of them, and could easily have obtained many more. When disturbed they at once jumped into the water usually rising with eyes above the surface a few seconds later.

Habits diurnal.

Desrciption (Mr. Boulenger's).—" Habit slender. Snout rounded as long as the orbit ; interorbital space broader than the upper eyelid. Fingers and toes moderately slender, the tips dilated into rather large disks ; first finger much shorter than second ; toes half-webbed ; subarticular tubercles feebly prominent ; a very small inner metatarsal tubercle. Hind limb remarkably long, the tibio-tarsal articulation reaching far beyond the tip of the snout; tibia two-thirds length of head and body. Skin, smooth. Brown above, with symmetrical blackish light-edged markings, a large one on the back being produced to between the eyes, where it expands into a transverse bar; side, from the shoulder to the lumbar region, black, with sharply defined upper outline; an oblique whitish streak from the eye to the base of the fore limb; a blackish spot at the knee, a dark cross-bar on the thigh, another on the femur, and a third on the tarsus; lower parts closely marbled with dark brown.

"From snout to vent 15 millim.

"This species connects *M. achatina* with *M. berdmor.*"

38. MICROHYLA BERDMORII, Blyth.

Microhyla berdmorii, Blgr., Cat. Batr. Sal., p. 166; S. Flower, P. Z. S., 1896, p. 908, and P. Z. S., 1899, p. 906; Laidlaw, P. Z. S., 1900, p. 888.

A *Microhyla* recently sent home from Perak by Mr. Wray was identified by Mr. Boulenger as this species, and one was obtained by the Skeat Expedition from Belimbing, Legeh. Previously it was known from the Peninsula only by a specimen obtained by Davison at Malacca. Flower describes it as "nocturnal, frequenting the neighbourhood of water, an extraordinarily good jumper."

Elsewhere it occurs in Burma, Siam, and Cambodia.

39. CALLULA PULCHRA, Gray.

Callula pulchra, Boulenger, Cat. Batr. Sal., p. 170 (fig.); S. S Flower, P. Z. S., 1896, p. 908, and 1899, p. 906; Laidlaw, P. Z. S. 1900., p. 888.

This singular rotund batrachian seems to be of very local distribution in the Peninsula, being apparently absent from many localities quite suited to its habits. Where it does occur it is usually exceedingly abundant. Hervey obtained it at Malacca; Flower found it plentiful in Singapore, but saw nothing of it in Penang; in Selangor it is very common in places; in Larut district in Perak I found it apparently absent, and I failed to find it on a journey through Pahang from Selangor to Lipis and down the Pahang river to the coast. Laidlaw says they are very plentiful at Khota Baru, Kelantan, extending down the East Coast to Tringganu, where, however, they became much scarcer than in Kelantan.

In dry weather these frogs are seldom seen or heard, but no sooner does a shower of rain fall than the air is filled with the volume of their croakings. Inflated until in shape they resemble rather flattened tennis balls, the males float in hundreds on the surface of every pool, ditch, and drain, and repeat their extraordinarily loud and strident cry of "ah-wauk" through day and night. Captain Flower in no way exaggerates when he writes that at close quarters, if they are plentiful, you can hardly hear yourself speak, "but at the distance of a quarter or half a mile the sound is not unpleasant, and is like that of a great weir or waterfall." It is, I should imagine, the very noisiest frog in the whole wide world.

Males have a single large vocal sac under the throat (globular when inflated), and their skin is profusely covered with a sticky slime. Flower says this slime dries into a white gum which dissolves in hot water and coagulates in cold, and "has a faint aromatic smell, not unpleasant." "*De gustibus* . . . "*!* I find *my* note is to the effect that the smell is "exactly like that of mice in an ill-cleaned cage!"

Females are not slimy, and have no vocal sac.

Specimens kept alive by Flower became very tame and showed considerable intelligence; they were nightly placed on the table-cloth to devour the termites and other winged insects which crowded to the lamps.

In Selangor I had many opportunities of observing the breeding-habits of this frog. The females appear able to carry the ripe spawn for an indefinite period until a shower provides them with water in which to deposit it, when they may be seen spawning in scores within an hour of the fall of the rain. Like many other Malayan batrachians they seem to have no forethought for the *future* water-supply for their offspring, and it is a common thing to see large masses of the spawn of this species and of *Bufo melanostictus* deposited in pools which are dried up again in a few hours. Millions of their tadpoles perish in this manner. The remarkably rapid development of the tadpoles is doubtless to some extent a provision against this, but I imagine the majority must generally perish. Considering the vocal powers of the adults this infant mortality can be contemplated without sadness!

On one occasion at Kuala Lumpur (25th July, 1900) a heavy shower fell at 11 a.m., filling to the depth of two or three feet a drain which had previously been dry. By 12 o'clock there were hundreds of *Callulæ* spawning in this water. I noticed that the embrace of the male is not pectoral but axillary (as might have been expected of a short-limbed frog with so stout a spouse !); the pair float on the surface of the water, the female at intervals submerging her head and bringing her vent high above the water ; a mass of ova the size of a cherry is then suddenly expelled, and is apparently fertilized by the male before sliding into the water. The couple then float motionless for a minute or two, when another cluster of eggs is passed, and so on. I give these details as notes on the breeding of the Engystomatoid Batrachians are few. Flower records the embrace as axillary in *Microhyla leucostigma.*

I took some of this spawn which I had seen deposited at noon ; the embryos in the ova were black above and white beneath. By 8 a.m. the following day they had uncurled into tadpoles, still in the spawn, and on my return from office at 4-30 p.m. they were free and swimming about. Their colour was then blackish. I left on a trip the next day and was unable to watch their development. Flower (P. Z. S. 1899, p. 903) seems to think that some transparent tadpoles (resembling those of *Microhyla*) which he obtained in Singapore belonged to this species ; if so, they must become transparent at a more advanced stage.

The drain from which this spawn was taken was completely dried up in four or five days when I returned and the teaming thousands of tadpoles in it had all perished.

Distribution.—" India, Ceylon, Burma, Southern China, Siam, Cambodia, Malay Peninsula, Celebes " (Flower).

40. PHRYNELLA PULCHRA, Blgr.

Phrynella pulchra, Boulenger, A. M. N. H. (5) XIX, 1887, p. 346, pl. x, fig. 2 ; S. S. Flower, P. Z. S., 1896, p. 910.

The types were from Malacca (Hervey). I can find no mention of its recent occurrence in the Peninsula. It is also known from Sumatra and the Mentawei Islands.

41. PHRYNELLA POLLICARIS, Blgr.

Phrynella pulchra, Günth., A. M. N. H. (5), XX., 1887, p. 313, pl. xvi, fig. B. ; L. Wray, S. S. B. R. A. S., 1890, No. 21, p. 141.

Phrynella pollicaris, Boulenger, P. Z. S., 1890, p. 37 ; S. S. Flower, P. Z. S., 1896, p. 910.

Discovered by Mr. L. Wray on the Larut Hills, Perak, at 3,000 ft. elevation, and so far known only from this locality. They inhabit holes in trees which contain rain water. When croaking they lie inflated on the surface of the water with limbs extended after the manner of *Callula pulchra.* In April 1900 I procured three examples on the Larut Hills. Two were captured in holes in trees, at about 3,500 ft. elevation. The colour of these two was dark blackish brown. The third specimen I took from a crevice in a rockery at the "Cottage," within a yard of a post marked "4,513 feet above M. S. L." The colouring of this example was quite different and was in life as follows: Pale yellowish clay colour, becoming yellower on the insides of the thighs. Tympanum, and a bar across the head between the eyes, grey; back faintly mottled with gray. Three greyish black bars across the thighs, two on the second, and three on the third joint of the hind limbs. Beneath, pale drab or stone-colour, strongly tinged with pinkish. Chin, and a line down centre of throat blackish.

An old specimen given me by Mr. Wray, caught at the same time as the type, has faded in spirit to a brownish red.

The croak of this frog is described by Mr. Wray as "loud, flute-like and musical."

Family *Bufonidæ.*

42. Nectes subasper, Tschudi.

Nectes subasper, Bouleng., Cat. Batr. Sal., p. 90.

The only locality in which I have found this curious toad is the little Sungei Buloh River in Selangor, on the banks of which, above the reach of tidal influence, they are not uncommon. I obtained four of them—an adult male and three smaller specimens—while on a trip up the river in 1898. Unfortunately all except the large specimen were subsequently lost. In October 1899 Mr. A. Hale, whom I had asked to try and get me more of these toads, procured me a very large female specimen. He caught three or four more, but these again were lost, through the overturning of a boat, I think.

The habits of this toad are aquatic and arboreal. They are usually found sitting on branches overhanging the water, into which they dive when disturbed. They are, as their fully webbed hind feet would lead one to suspect, powerful swimmers. When the males are croaking the blackish pouch under the throat is inflated to the size of a pigeon's egg. Their croak is generally uttered three or four times in very rapid succession and then followed by an interval of silence.

My two examples measure, from snout to vent, female $5\frac{5}{8}$ inches, male $3\frac{31}{40}$.

Colour.—Above dark chocolate or blackish brown. A light brown vertebral stripe commences between the eyes and terminates a little before the vent. A stripe commencing from the eye and passing through the lower half of the tympanum to the base of the forelimb, and a conspicuous lateral stripe from above the forelimb to the base of the hind, dirty brownish white. A transverse whitish line, less distinct, below the vent, Beneath, including lower surface of thighs and half tibial joint, dirty brownish white, covered with minute dark dots. Throat, in the male, grey. Along the sides the whitish colour of the lower surface shades into, and is mottled with, the brown of the back.

The large warts on the back and limbs of this toad are pitted with small punctures; on some tubercles there are as many as 18 or 19 of these pores.

Nectes subasper was discovered in Borneo; my specimens appear to be the first obtained in the Peninsula.

Since writing the above I have seen a specimen of this toad in the Raffles Museum. There is no note of locality and it probably came from Borneo.

Habitat.—Borneo, Java, Selangor.

43. NECTOPHRYNE GUENTHERI, Blgr.

Nectophryne guentheri, Blgr., Cat. Batr. Sal., p. 280, pl. xviii, fig. 3; S. Flower, P. Z. S., 1896, p. 910, and P. Z. S. 1899, p. 908.

Bukit Timah, Singapore, seems to be the only locality in the Straits from which this small toad has been obtained; Mr. Ridley and Mr. Flower each procured two specimens from there. Mr. Ridley, however, told me that he thought he had seen it several times, and in June 1900 he and I had a search together for it, Mr. Ridley succeeding in finding another specimen crawling on a rock in a ravine in jungle. This example he kindly allowed me to keep for the Selangor Museum. Known from Singapore, Mentawei Islands, Natunas, and Borneo.

44. BUFO PENANGENSIS, Stol.

Ansonia penangensis, Stol., S. A. S. B., 1870, p. 152, pl. ix, fig. 4;

Bufo penangensis, Bolugr., Cat. Batr. Sal., p. 287 ; S. Flower, P. Z. S., 1896, p. 911 ; P. Z. S., 1899, p. 908.

Discovered by Stoliczka in Penang ; since obtained by Flower in Penang (2,000 feet) and on the Larut Hills, Perak (3,000 feet) ; on the Larut Hills by L. Wray and on Gunong Kledang, Perak, by Dr. Hanitsch.

On a recent trip in the Larut Hills I obtained a large series (21 specimens) of this little toad, at elevations between 2500 feet and 4,000 feet above m. s. l. Mostly found in holes in, or clinging to, banks or tree-trunks. Nearly always found in pairs, a few inches apart : often two or three pairs quite close together. This was in March and April. They are very sluggish and easily caught. The colour varies a good deal, some being much brighter than others. The light markings in some are dull orange, in others almost a chrome yellow.

Eight specimens measure in inches from snout to vent, $1\frac{1}{8}$, $1\frac{1}{8}$, $1\frac{1}{10}$, $1\frac{1}{10}$, $1\frac{1}{10}$, $1\frac{1}{10}$, $1\frac{1}{20}$, $1\frac{19}{20}$,

The tadpoles have been described and figured by Flower, (P. Z. S., 1899, pl. lx, figs. 3 and 3*a*). They are found in swift running hill-streams, attached to the face of rocks by the mouth, which is enormous and " forms an organ of adhesion and locomotion."

45. BUFO MELANOSTICTUS, Schneid.

Bufo melanostictus, Boulenger, Cat. Batr. Sal., p. 306 ; id. Rept., Fauna Ind., p. 505 (fig. p. 506) ; S. S. Flower, P. Z. S., 1896, p. 911, pl. xliv, fig. 3 ; id. P. Z. S., 1899, p. 910 ; Laidlaw, P. Z. S., 1900, p. 888.

Very abundant and widely distributed through the Peninsula. Its habits are very similar to those of *Bufo vulgaris*. I saw a single (male) specimen of quite a brilliant yellow colour, with the black spots on the ridges of the head very distinct.

Flower gives the distribution of the species as " India, Ceylon, Burma, Sikhim, Himalayas (up to 10,000 feet), Southern China, Hong-kong, Cambodia, Siam, Malay Peninsula, Java, Borneo, Philippines.

46. BUFO PARVUS, Blgr.

Bufo parvus, Blgr., A. M. N. H. (5), XIX., 1887, p. 346, pl. x ; S. Flower, P. Z. S., 1896, p. 912, and P. Z. S., 1899, p. 911 ; Laidlaw, P. Z. S., 1900, p. 888.

Mr. Hervey's Malacca collection contained numerous examples, and Captain Flower obtained a specimen in November 1896 near the Waterfall Gardens, Penang. Known from Pegu, Malay Peninsula, and Sumatra. Recently obtained by the Skeat Expedition from Biserat, Jalor, and from Ulu Selama, Perak.

47. Bufo jerboa, Blgr.

Bufo jerboa, Boulenger, P. Z. S., 1890, p. 328, pl. xxv., fig. 3; Laidlaw, P. Z. S., 1900, p. 889.

The Skeat Expedition obtained a single specimen on Gunong Inas.

Previously known from Borneo.

48. Bufo quadriporcatus, Blgr.

Bufo quadriporcatus, Blgr. A.M.N.H. (5), XIX, 1887, p. 347, pl. x, fig. 4; Günth. A.M.N.H. (5), XX. 1887, p. 314, pl. xvi, fig. C.; S. Flower, P. Z. S., 1896, p. 912, and P. Z. S. 1899, p. 911.

The type was from Malacca from Mr. Hervey. It has been twice obtained by Mr. Wray on the Larut Hills, below 800 ft. I have never met with it, and my only specimen was obtained in exchange from the Raffles Museum (collected at Baram, Borneo, by Mr. C. Hose). Known from the Malay Peninsula, Borneo and Sumatra.

49. Bufo divergens, Peters.

Bufo divergens, Bouleng., Cat. Batr. Sal., p. 312, fig.

I obtained a young specimen in 1898, on the bridle-track between Kuala Lumpur and Ginting Bedei, identified for me by Mr. Boulenger.

It had a yellow vertebral stripe. Found among dead leaves in jungle. This appears to be the only record from the Peninsula. Previously known from Borneo.

50. Bufo asper, Gravenh.

Bufo asper, Günther, Rept. Brit. Ind., p. 423; Stol., J. A. S. B., 1873, p. 113; Boul., Cat. Batr. Sal., p. 313; id. Fauna Ind., Rept., p. 507; S. S. Flower, P. Z. S., 1896, p. 911, pl. xliv, fig. 3; id. P. Z. S., 1899, p. 910; Laidlaw, P. Z. S. 1900, p. 888.

Bufo asper, the finest toad in the Peninsula, seems to be widely, though locally, distributed. In some districts it is to be found in abundance in certain caves and in the neighbourhood of waterfalls, but is seldom met with away from these particular haunts. Recorded Peninsula localities seem to be Jelebu, Malacca, Penang, Batu Caves in Selangor (where it is found in total darkness, half a mile underground), Belimbing in Legeh, Biserat in Jalor, Kuala Aring in

Kelantan. I have also met with it at 4,500 ft. elevation on the Larut Hills, Perak, and on the Semangko Pass between Selangor and Pahang. In the latter locality I found them inhabiting little tunnels six inches or a foot deep, apparently made by themselves, in banks of sandy soil.

If laid on its back and tickled on the breast with the finger this toad will invariably fold its arms across its chest and lie as if dead, remaining thus for a considerable time after it has been left to itself. I have recollections of a picnic at the Batu Caves when a number of these toads thus entranced were laid in a row, affording considerable amusement!

Flower gives the length of his largest specimen as $6\frac{3}{4}$ inches, and the distribution of the species as Tennasserim, Mergui, Malay Peninsula, Java and Borneo.

Family *Pelobatidæ*.

51. LEPTOBRACHIUM HASSELTII, Tschudi.

Leptobrachium hasseltii, Doul., Cat. Batr. Sal., p. 441; Rept. Fauna of Ind., p. 511; P. Z. S., 1890, p. 37; S. Flower, P. Z. S., 1896, p. 913; P. Z. S., 1899, p. 913.

There is a specimen in the British Museum from Singapore from Mr. Ridley; there are also specimens in the Raffles Museum, and larvæ in the Perak Museum obtained at Taiping.

This frog seems to be able to keep itself from observation very successfully! It must be quite common in Selangor, at least near Kuala Lumpur. I can always obtain any number of tadpoles at any time of the year, but so far I have only succeeded in capturing a single adult, which measured $1\frac{13}{16}$, in. from snout to vent. I noted the colour in life as;

Greyish brown above, marked with large dark-brown patches, arranged in three irregular rows down the back, and each narrowly margined with whitish. A black line runs from the upper lip to the nostril, and back through the eye over the tympanum. Sides greyish, marked with black spots and blotches. Hind limbs barred and blotched with black; inside of thighs and anal region light greenish blue. Lower surface greyish white, finely mottled throughout with brown. Eyes very prominent, entirely black. The larval period of existence in this species is very prolonged, and the tail does not disappear until almost the full size of the adult is attained. My tadpoles were identical in the specimens identified by Mr. Boulenger.

Distribution.—Burma, Malay Peninsula, Java.

52. LEPTOBRACHIUM PELODYTOIDES, Blgr.

Leptobrachium pelodytoides, Boulenger, Ann. Mus. Genova (2), XIII, 1893, p. 345, pl. xi., fig. 3.

There was a single specimen—identified by Mr. Boulenger—among some reptiles recently sent home from Perak by Mr. Wray.

Previously known from the Karin Hills.

53. LEPTOBRACHIUM HETEROPUS, Blgr.

Leptobrachium heteropus, Bouleng., Ann. and Mag. Nat. Hist. (7) Vol. VI, 1900, p. 186.

I obtained the type of this new species on the Larut Hills, Perak, at 3,500 feet elevation in April 1900. It is now in the British Museum. Mr. Boulenger's description is as follows :—

" Tongue large, pyriform, feebly notched behind. Vomerine teeth none. Head moderate, as long as broad ; snout short, truncate at the end ; canthus rostralis strong ; loreal region concave ; interorbital space as broad as the upper eyelid ; tympanum distinct, half the diameter of the eye. Fingers moderate, blunt, first and second equal ; toes moderate, blunt, webbed at the base only, the web continued as a slight fringe along each side of the toes ; a strong dermal ridge or keel, formed by a modification of the subarticular tubercles, runs along the lower surface of the third and fourth toes, which thus appear to be compressed ; a small oval inner metatarsal tubercle. The tibio-tarsal articulation reaches the centre of the eye. Skin smooth, with small tubercles on the upper eyelids. Grey above with darker light-edged symmetrical markings, the largest occupying the middle of the back ; a black lumbar spot ; a black canthal and temporal streak ; black spots on the sides ; dark cross-bars on the limbs ; lower parts grey, speckled with black ; a round whitish spot on each side of the breast, at the base of the arm, another on the back of each thigh.

" From snout to vent 33 millim.

" This species is closely allied to *L. pelodytoides*, Blgr., from which it may be distinguished by the lesser web and the extraordinary dermal ridges under the toes, a point of structure which is only foreshadowed in the types of *L. pelodytoides*."

54. MEGALOPHRYS NASUTA, Schl.

Megalophrys montana, Var., Cantor, p. 140.

Megalophrys montana, Part., Günther, Rept. Brit. Ind., p. 413.

Megalophrys nasuta, Bouleng., Cat. Bat. Sal., p. 443 ; S. Flower, P. Z. S., 1896, p. 913 ; Laidlaw, P. Z. S., 1900, p. 889.

I have not myself seen this Horned Frog—locally known as the "Winking Toad"—alive. I have two Selangor specimens in the museum and one from Perak given me by Mr. Wray. In the latter state, judging from the number of specimens in the Taiping Museum, it is apparently more numerous than in Selangor. Mr. H. N. Ridley tells me it is not rare in Singapore. It has also been taken in Penang, Malacca, and Johore. Forbes ("Naturalist's Wanderings," pp. 154 and 155) says of this species : "The horned frogs (*Megalophrys nasuta*) were abundant, whose anvil-like clinking "Kang-kang" filled the air in the evenings ; but in simulating so closely the dead leaves among which they lay, it required the closest search to find them. Lying flat on the ground their sharp acute horns mimicked the points of leaves, from which lines radiated representing crossing and overlapping margins, while dark-brown spots and markings distributed over their bodies could not be told from the blotches and fungoid growths of decaying vegetation. *In coitu* the male embraces the female round the lumbar region." This was written from Penanggangan, in Sumatra.

My three specimens measure :—

	in.	in.	in.
Length, point of snout to vent	$4\frac{3}{8}$	$4\frac{5}{8}$	$2\frac{7}{6}$
Breadth of head at gape	$2\frac{1}{5}$	$2\frac{1}{16}$	$1\frac{5}{6}$

Thus in two of these three examples the width of the mouth exceeds half the total length of the head and body.

It occurs in Borneo, as well as in the Malay Peninsula and Sumatra. It is principally a low country species, but has been obtained on the hills in Penang at 1,800 ft.

55. MEGALOPHRYS MONTANA, Kuhl.

Megalophrys montana, Blgr., Cat. Batr. Sal., p. 442 ; S. Flower, P. Z. S., 1899, p. 914 ; Laidlaw, P. Z. S., 1900, p. 889.

Mr. Flower in a note after *Megalophrys nasuta* says : "A frog in the museum at Taiping, said to have been caught in Perak, apparently belongs to this species (*M. montana*)." He gives the distribution of the species as "Java, Sumatra, Dinagat Island, Malay Peninsula (possibly)."

I think the species should have a place on our list. Mr. Wray and I recently compared the Taiping specimen with the description in the Catalogue, with which it agrees well, and there is no doubt as to the locality, there being no old specimens from outside the Peninsula in the stores of the Taiping Museum.

Since writing the above the capture of five specimens by the Skeat Expedition, from Bukit Besar, Jalor, and Gunong Inas has removed all doubt of this frog's occurrence in the Peninsula.

56. MEGALOPHRYS LONGIPES, Blgr.

Megalophrys longipes, Bouleng. P. Z. S. 1885, p. 850, Pl. lv.; Günther, A. and M. N. H., 1887 (5), XX., p. 316; S. Flower, P. Z. S., 1896, p. 913; Laidlaw, P. Z. S., 1900, p. 890.

Flower writes of this species: "Mr. Wray obtained three specimens from the mountains of Perak, at from 3,300 to 4,400 feet above the sea. It is apparently rare and local."

Local it seems to be, but so from being rare it is the commonest frog on the hills above 3,000 feet.

During a recent stay of a month on the Larut Hills, Perak, I obtained no less than 56 specimens, and could have got 100 had I wished.

I found them from 3,000 to 4,500 feet altitude, commonest, at the higher elevation, but disappearing suddenly above that altitude. They appear to be entirely nocturnal in their habits, and in the day time were always found under logs, rocks or in holes in banks, and, in densely shaded spots, among dead leaves. Excluding toads they are the easiest Batrachian to capture I have known. They appear to be quite bewildered by the sunlight, and when disturbed give one jump into the open and make no attempt to escape. When seized in the hand they frequently open their mouths widely for some seconds—a very unfroglike proceeding!

In colour they vary exceedingly, from dark olive brown to dark or light orange-red, some being of exactly the same tint as the red variety of *Rana macrodon* figured by Flower, P. Z. S., 1896, Pl. XLV.

The following description of a brown one is from life: General colour dark olive brown above, a broad isosceles-triangle mark on the head, the base of the triangle lying between the horns over the eyes, the apex pointing backwards. This triangle is dark brown, narrowly edged with whitish. Horns over eyes yellowish white. A cream-edged brown mark from the eye through the tympanum. Throat, lips, and lower surface greyish brown, mottled with cream colour. Fore limbs mottled light and dark brown, a black patch on the inside just above the hand. Hind limbs light brown, mottled and barred with dark brown; a black mark, edged above with cream colour, on the anal region, extending a little way down the thighs. Lower surface of hind feet black, edged on the outside with cream colour. Pupil black, vertical, diamond shaped, edged with golden; remainder of iris brown mottled with coppery-golden specks.

The triangular mark on the head of this species seems to be quite constant; it was more or less distinct in every specimen of my large series.

Some of the brown specimens are marked with orange-red spots. In a few the inside of the thighs was tinged with greenish blue.

Nine of my specimens measure :

	1.	2.	3.	4.	5.	6.	7.	8.	9.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
Snout to vent	$2\frac{1}{16}$	$2\frac{3}{5}$	$2\frac{7}{10}$	$2\frac{23}{40}$	$2\frac{3}{5}$	$2\frac{23}{40}$	$2\frac{3}{5}$	$2\frac{3}{5}$	$2\frac{5}{8}$
Breadth of head at gape...	$\frac{39}{40}$	$\frac{37}{40}$	$\frac{9}{10}$	$\frac{7}{8}$	$\frac{9}{10}$	$\frac{37}{40}$	$\frac{19}{20}$	$\frac{37}{40}$	$\frac{19}{20}$
Hind foot	$2\frac{1}{8}$	$2\frac{1}{10}$	$2\frac{1}{10}$	$2\frac{1}{10}$	$2\frac{1}{40}$	$2\frac{3}{40}$	$2\frac{1}{8}$	$2\frac{3}{20}$	$2\frac{1}{8}$

The smallest specimen obtained measured $\frac{9}{10}$ inch, hind foot $\frac{7}{10}$ The Skeat Expedition found this species fairly common on Gunong Inas from 3,000 feet upwards.

Common as this frog is on the hills I have never seen it enter water of its own accord. I have twice found on the hills clusters of about a dozen very large frog's ova deposited under damp moss on tree trunks. These eggs were about half an inch in diameter and contained tadpoles with the hind limbs and tail well developed. It seems to me most likely that they belonged to *Megalophrys longipes*, and that the larval existence of this frog is not aquatic.

Order Apoda.

Family *Cæciliidæ*.

57. Icthyophis glutinosus, Linn.

Epicrium glutinosum, Günth., Rept. Brit. Ind., p. 441 (1864).

Icthyophis glutinosus, Blgr., Cat. Batr. Grad., p. 89, pl. iv., fig. 2 (1882); Blgr., Fauna Brit. Ind., Rept., p. 515, fig. p. 516; S. Flower, P. Z. S., 1896, p. 914, and P. Z. S., 1899, p. 914.

This curious Cæcilian has been obtained from several different localities in the Peninsula up to an elevation of 4,000 ft. It seems, however, to be very uncommon.

Distribution.—Mountains of Ceylon, Malabar, Eastern Himalayas, Khasi Hills, Burma, Siam, Malay Peninsula, Sumatra, Mentawei Islands, Borneo, Java.

58. ICTHYOPHIS MONOCHROUS, Blgr.

Icthyophis monochrous, Blgr., Cat. Batr. Grad., &c., p. 91, pl. iv., fig. 1 ; Rept. Fauna of Brit. Ind., p. 517 ; S. Flower, P. Z. S., 1896, p. 914 ; P. Z. S., 1899, p. 916.

This species was until lately known from the Peninsula only by a specimen dug up in a garden in Singapore 1863, and given by Dr. Montgomerie to Cantor. It is now in the British Museum. In April 1898, Flower obtained two specimens under a stack of firewood near Maxwell's bungalow on the Larut Hills, elevation 3,380 feet, and in April this year two examples were brought to me by coolies who were cutting back the banks of a road on the same hills, at 4,000 ft.

Elsewhere it has been obtained in Borneo, Java, and India (Sikhim, Western Ghauts, Surat, Malabar).

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THE USE OF CALMETTE'S ANTIVENENE IN SNAKE-BITE IN INDIA.

By Lt.-Colonel W. B. Bannerman, M.D. (Edin.), B.Sc., F.R.S.E., Indian Medical Service.

(*Read before the Bombay Natural History Society on 5th November* 1903.)

On the 21st of January 1902 Captain Lamb, I.M.S., read a paper before our Society on "Snake Venoms: Their Physiological Action and Antidote" which you will find published at p. 220 of Vol. XIV of this Journal. In this paper he showed that the antivenene prepared by Calmette, of the Pasteur Institute at Lille, was useful when administered in time and in sufficient amount, in cases of cobra bite, but useless as an antidote for Daboia poison. In Vol. XV of the Journal at p. 112 appears an article by Fleet-Surgeon P. W. Bassett-Smith, R.N., entitled "Snake-bites and Poisonous Fishes" in which it is stated, on the authority of Calmette, that his antivenene was capable of protecting "animals and man from lethal doses of *any* venom, although each snake venom has, *per se*, well marked toxic peculiarities producing several and various local phenomena."

Naturally these contradictory statements appearing in the Journal of the Society have caused perplexity to some of the members, and the Secretary has asked me, in the absence of Captain Lamb, to give a short account of his investigations, and to reconcile the two statements if possible.

It must be said here that Bassett-Smith's article was originally published in 1902 in the Encyclopædia Medica and, therefore, can only represent the state of our knowledge prior to that date, and that he could not possibly know of Captain Lamb's results, as these were not published till a later period.

Having cleared the way by these preliminary remarks let me present to you, by means of these tables, a bird's-eye view of the various ways in which venoms of some of the Indian snakes act.

I can only give tables of the actions of the venoms of cobra (*Naia tripudians*), Russell's viper (*Daboia Russellii*) and banded krait (*Bungarus fasciatus*) as these are all that Captain Lamb has yet been able to deal with, owing to the difficulty of collecting material. This is, I think, a matter, so full of importance to the well being of India, that the Society would do well to represent it in the proper quarter, and so help Captain Lamb to complete his series of valuable investigations, by calling the attention of Government to the necessity of assistance in collecting live venomous snakes, for the purpose of extracting their poison.

Cobra Venom—	Daboia Venom—	Banded Krait Venom—
1. Acts on central nervous system, *i.e.*, the brain and spinal cord. This causes paralysis of the limbs, then of the muscles of respiration. The heart continues to beat long after the breathing has stopped.	1. Does not produce definite symptoms pointing to direct action on the nervous system. Whether there is any action at all, is now being worked out.	1. Acts on the central nervous system much in the same way that cobra venom does. Profuse salivation and vomiting is common. Paralysis with twitching of muscles comes on, and death ensues from paralysis of respiration in two or three days.
2. Acts on the blood also, causing a breaking up of the red corpuscles of the blood, and a lengthening of the time the blood takes to coagulate. These physiological effects are of little importance as far as the symptoms of cobra venom intoxication are concerned.	2. Acts on the blood plasma, the corpuscles, the walls of the small blood vessels (capillaries) and the heart. In acute cases the symptoms produced are, giddiness followed at once by violent convulsions and gasping for breath, death resulting in a few seconds.	2. Acts on the blood in almost the same way as Daboia venom does (*if injected in very large doses*), causing death in a few minutes from extensive clotting of the blood in the pulmonary arteries and right side of the heart. The red cells of the blood, however, are only acted on in a quite minor degree, and no symptoms observable during life are produced by this.
3. Causes death in from 3 to 6 hours after the bite is inflicted as a rule, though this period may be as long as a day or two.	3. The cause of death in these cases* is from clotting of the blood in the pulmonary arteries and some of the other blood vessels.	3. Or serious symptoms may not come on for some days, but there is loss of appetite and weight, followed by great depression, marked diminution in the urinary secretion, slight failure of respiratory functions, irregular elevations of temperature, great muscular weakness and paralysis. Purulent discharges from eyes, nose and rectum are also seen. Death ensues in from 6 to 12 days. In these cases it has been found that there occurs "a well marked primary degeneration of the cells of the central nervous system." (1)
4. Does not produce symptoms immediately,—an interval, generally of an hour or two, elapsing before they appear, during which treatment may be applied.	4. When the dose is not large enough to cause this intravascular clotting, death (*a*) may ensue in a few hours from failure of the heart or (*b*) may follow after a longer time, from the distinctive action of the poison on the red corpuscles, and capillary walls allowing the blood to exude, and producing œdema and hæmorrhage, in many parts of the body, and its further action in preventing the proper coagulation of the blood. Death is also frequently due to bacterial invasion causing septicœmia, malignant œdema, etc. This invasion of bacteria is due to the fact that locally, at the site of inoculation, the tissues die and a large slough forms. The corpuscles are largely destroyed and the fluid part of the blood stained red by their colouring matter.	
5. Breaks up general tissue cells, such as those of the kidneys, liver, etc. This is a property common to all the venoms worked with up to date.	5. Other cells of the body are also broken up, as with other snake venoms.	

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* *Note.*—This action will probably only be seen in experiments on animals; under natural conditions the amount of venom injected will be insufficient to produce such extensive clotting. It results when a sufficient amount of venom is injected into the blood stream directly.

From a study of these tables one realises how differently snake venoms act—one acting through the nervous system with incredible rapidity, another requiring some days to produce its equally fatal results, while a third acts almost entirely on the blood.

Realising this then, is it much wonder that scientists looked askance on Calmette's sweeping assertion, that his antivenene was useful for the bites of all poisonous snakes; knowing, as they did, that the venom used by him to produce immunity in the horse was that of the cobra, with only small additions of other snake venoms? (2)

Behring, the great authority on serum-therapy, and whose name you must all be familiar with in connection with anti-diphtheritic serum, lays it down as a law that "the action of an immunising serum is specific"; that is, in other words, an immunising serum is only useful in the case of the disease or toxine by means of which it has been prepared, *e.g.*, anti-diphtheritic serum is only of use against diphtheria, not against plague or tetanus or any other bacterial disease.

Everyone now admits this, so it is not astonishing to find that a serum prepared by injecting a horse with the nerve-destroying cobra venom should be quite inactive in cases of poisoning by the blood-destroying Daboia poison.

The first published account of experiments undertaken to investigate this point was by Professor C. J. Martin, of Melbourne, now Director of the Lister Institute, London (Inter-Colonial Med. Journal of Australasia, Augt. 20, 1897, and Apl. 20, 1898), who showed that Calmette's serum was useless against the poison of the Australian tiger snake (*Hoplocephalus curtus*).

Since then, Tidswell, of Sydney, has proved (3) that it is equally useless for the other poisonous snakes of Australia. He has gone a step further, however, for he manufactured a serum by injecting a horse with Hoplocephalus poison, which was highly effective in preserving animals from the effects of that poison, but wholly useless against three other Australian snakes, *viz.*, the brown snake, the black snake (*Pseudechis*) and the death adder (*Acanthophis*), though these belong to the same sub-family Elapinæ of the Colubrine class.

These observations have been further extended by Captain Lamb, I.M.S., who, working with serum sent to him by Dr. Tidswell, proved that this Hoplocephalus serum (4) "has no neutralising power for the venoms of three of our Indian snakes, *viz.*, *Naia tripudians* (cobra), *Bungarus fasciatus* (banded krait), and *Daboia Russellii* (chain viper)." Now this serum had been made by the use of one kind of venom only and was, therefore, better fitted for testing the question of specificity than Calmette's, which is prepared by using cobra venom mixed in varying proportion with that of other serpents. The amount of cobra venom, used, however, appears to be so preponderating, that for practical purposes it also may be regarded as a specific serum, useful only against this one kind of poison.

In the paper communicated by Captain Lamb to our Journal, you will find an account of how the serum is procured and the method of using it in cases of cobra bite. I need not, therefore, go over that ground again, but would merely remind you, that if given in sufficiently large doses, and before symptoms of the venom intoxication have become pronounced, we have in Calmette's antivenene a safe and good remedy for cobra bite.

But alas! when we turn to the other dangerous snakes of India we find the serum wholly useless. Captain Lamb and Dr. Hanna, (5) working together in the Parel Laboratory, have conclusively proved that antivenene is powerless to prevent death in animals poisoned by the venom of the chain viper (*Daboia Russellii*). Since then Captain Lamb (4) has been able to test Calmette's antivenene against the poisons of the banded krait (*Bungarus fasciatus*) and the phoorsa (*Echis carinata*).

I need not describe the long series of experiments by which he proved his point; those of you who desire to read of these must go to the original paper, published by Government as No. 5 of the New Series of Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. Those of us who know the experimenter and his careful methods will realise the weight that must be given to his conclusion, that Calmette's antivenene (p. 5) "is of no value whatever in the treatment of cases of bites from *Daboia Russellii*, *Bungarus fasciatus*, or *Echis carinata*."

In summing up his observations on Calmette's antivenene and Tidswell's Hoplocephalus serum he says: (p. 6) "We have seen that the Australian snakes belong to the same sub-family, but to different genera as the cobra and the banded krait. These results therefore, taken along with the results collated above, got with Calmette's serum, show conclusively that the serum prepared with the venom of any one genus of poisonous snake is specific for the venom of that genus and is inactive for the poisons of other genera. It still remains to be shown if a serum prepared with a single venom would be specific for the venom of that species, that is to say, inactive for the poisons of other species of the same genus."

Since this was written, Captain Lamb tells me he has been able to test antivenene prepared with pure cobra venom, against the venom of the king cobra (*Naia bungarus*), and that to a very large extent it appears to be inactive, though, as we have seen, useful for bites by the cobra (*Naia tripudians*), a different species of the same genus.

This, if confirmed by further research, will go to prove that the antivenomous serums produced up to the present are absolutely specific, and only useful for the particular poison which called them into existence.

You will realise, then, that the question of a cure for bites by Indian snakes is not a simple one, but that it will require perhaps years of patient research for its elucidation, and not till such work is accomplished can we hope to have placed in our hospitals a cure for the victims of these dreaded accidents.

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4. Specificity of Antivenomous Sera. By George Lamb, M.D., (Glasg.), Captain, I.M.S. No. 5, Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. Calcutta, Office of the Superintendent of Government Printing, India, 1903.

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ON TWO DOLPHINS FROM MADRAS.

BY R. LYDEKKER.

(*With Plates C and D.*)

(*Read before the Bombay Natural History Society on 5th November 1903.*)

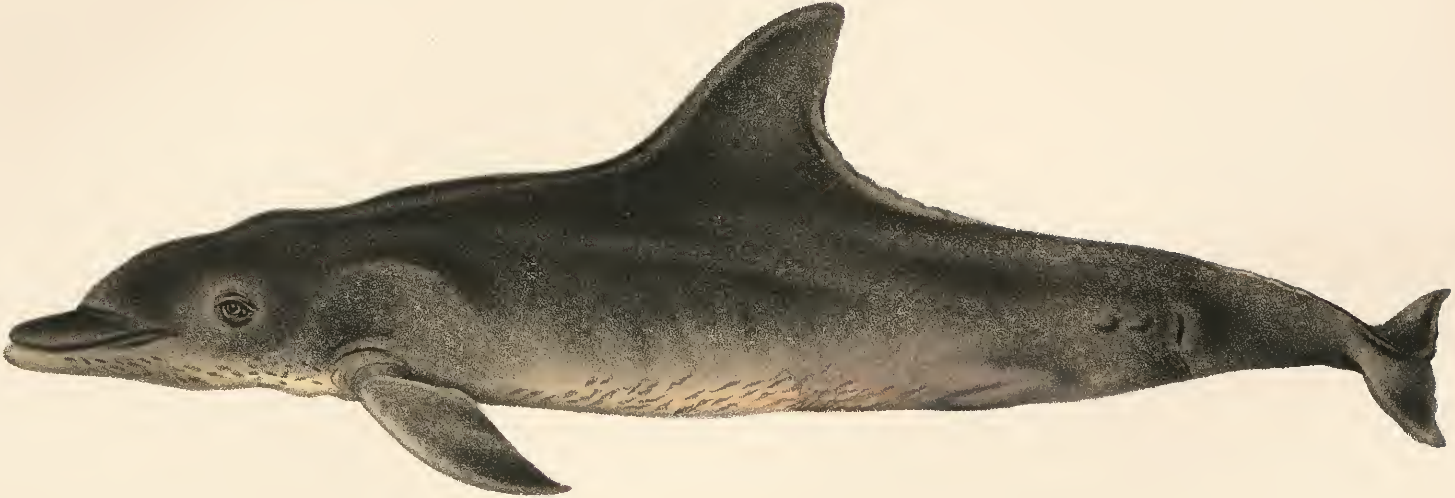
Students of the Indian Cetacea are once more indebted to Mr. Harold Ferguson, Director of the Travancore Museum, for adding to our knowledge of the smaller representatives of that group. At the end of May last I received from that gentleman sketches of a couple of dolphins, of different species, which had been stranded during the previous March on the Trevandrum beach, with a notification that the disarticulated skeletons would follow in due course. Soon after the arrival of the latter in June, I set about determining the specimens, and have arrived at the conclusion that the larger represents a species of *Tursiops* not hitherto definitely known from Indian waters, while the smaller indicates a *Sotalia* nearly allied to *S. lentiginosa*, but yet apparently distinct. I am glad to say that in both instances these identifications, so far as the genus is concerned, agree with provisional determinations made on the spot by Mr. Ferguson. The real interest and importance of the specimens is, however, due to the fact that the entire skeletons have been preserved. In the case of the smaller specimen this has enabled me to determine, with much greater precision than was previously possible, the real generic position of several nearly related Indian forms. I may add that if other naturalists resident on the coasts of the peninsula were as energetic and painstaking as Mr. Ferguson in collecting specimens, when opportunities occur, our knowledge of the smaller Cetacea of India would soon be in a much more satisfactory condition than is at present the case. With these preliminary observations I proceed to the consideration of the specimens :—

THE AUSTRALIAN BOTTLE-NOSE (*TURSIOPS CATALANIA*).

Plate C.

This species was described by Dr. Gray on the evidence of two skulls brought from the north-west coast of Australia by Mr. J. Macgillivray, who made notes on the external form and colouring of the animals to which they belonged. The following is an abbreviation of Gray's description :—

" Upper surfaces lead-colour passing gradually on the sides into the white of the lower surfaces ; sides, lower surfaces and pectoral fins



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Mintern Bros lith. London.

TURSIOPS CATALANIA.

Scale 1' to 1".

covered with longitudinally elongated blotches of dark lead-colour. Teeth, $\frac{25}{25}$. Skull like that of *T. tursio*, but smaller; the rostrum, longer (about three-fifths the total length) and narrower."

The total length of the larger individual was 6 feet 9 inches, and that of the skull 17 inches.

Of the Trevandrum specimen, which was stranded on March 7th, the taxidermist at the museum has supplied the following details :—

	Ft.	inches.
Extreme length	7	4½
From tip of beak to origin of back-fin	3	4½
„ „ „ „ „ flipper	1	10½
„ „ „ anal aperture...	5	3½
Length of front margin of flipper	1	5
„ „ „ „ back-fin	1	5
Expanse of flukes	2	2
Greatest girth	3	11
Height of back-fin	1	0

"Lower jaw somewhat larger than upper. A prenarial fatty convex elevation marked off from the moderately tapering beak by a V-shaped groove.

"Body rounded anteriorly; tail much compressed laterally; a prominent ridge from the back-fin to the middle of the flukes; the ridge on the middle portion less conspicuous.

"Colour above deep glistening plumbeous black, becoming paler below, washed with irregular black markings. Genital and anal regions mottled with dark brown. Lower jaw and sides of lower lip light plumbeous, passing into pale yellowish in front.

"Teeth, $\frac{25}{25}$.

"Pterygoids divergent posteriorly.

"Ribs, 12, the first four double-headed.

"Vertebræ, C. 7; D. 12; L. 15; Ca. 24 = 58.

"The animal appears to have sustained serious injuries in different parts of the body. The tips of the dorsal and left caudal fins had been bitten off and had subsequently healed. Some of the caudal series of vertebræ had been fractured, and presented a distortion due to subsequent fusion."

The length of the skull (which, from the worn condition of the teeth evidently belonged to an old animal) is 18½ inches. As regards general external form, the characters of the skull (save in one particular), the size, and number of the teeth, and the number of the vertebræ, the specimen agrees so well with the generally accepted definition of *Tursiops*, that the species to which it belongs may be confidently assigned to that genus. It is true that the number of vertebræ is three less than the minimum hitherto regarded as distinctive of that genus (1); but since in *T. tursio* the number is 64, while in *T. abusalam* it is 61, there is no good reason why a third form with only 58 should not be included in the same genus. The range of specific variation in regard to the dental and vertebral formulas of the three species under consideration is indicated by the following table :—

Tursiops tursio—
  Teeth, $\frac{22}{22}$.
  Vertebræ ; C. 7 ; D. 13 ; L. 17 ; Ca. 27 = 64.
Tursiops abusalam—
  Teeth, $\frac{26}{26}$.
  Vertebræ ; C. 7 ; D. 12 ; L. 16 ; Ca. 26 = 61.
Present specimen—
  Teeth, $\frac{25}{25}$.
  Vertebræ ; C. 7 ; D. 12 ; L. 15 ; Ca. 24 = 58.

It will be noticed that in the above-quoted description, the pterygoids are stated to be divergent posteriorly, whereas in *Tursiops* they are described as in contact throughout their length (2). On examination of the skull, I find, however, that their bones have undergone absorption to a large extent, and their remaining portion is much fenestrated. Their present posterior divergence is therefore, I consider, entirely due to senile degeneration, and I have no doubt that when the animal was younger they presented the form and relations characteristic of the genus.

As regards general size and proportions, the number of the teeth, and colour (especially the "elongated blotches of dark-lead colour" on the under surface, so clearly indicated in the sketch), the Trevandrum bottle-nose agrees so closely with the description of *T. catalania*, that there seems every reason for regarding it as referable to the same species. It is true the sketch does not show the spotting on the flippers mentioned in the description of the types of the latter, and also that there the flippers and back-fin appear proportionately a little longer in the Trevandrum specimen, but I cannot regard such differences as of specific value ; they may vary, for instance, with age.

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(1) See Trans. Bull. U. S. Mus. No. 36, p. 158 (1889).

(2) See W. H. Flower, Proc. Zool. Soc., London, 1888, p. 178, fig. 5.

In regard to the occurrence of bottle-nosed porpoises other than the typical *Tursiops tursio* in Indian waters, Dr. Blanford wrote as follows in his volume on the Mammalia in the " Fauna of British India " :—

" It is highly probable that either *Tursiops catalania* described from N.-W. Australia, or the closely allied *T. abusalam* inhabiting the Red Sea, is also found in the neighbourhood of India. The two may be identical. Both are smaller than *T. tursio* and have dark spots on the lower surface."

The present specimen (assuming my identification to be correct) not only converts this suggestion into a certainty, but serves to show that *T. catalania* (of which the vertebral formula is now for the first time ascertained) is perfectly distinct from the Red Sea species. The accompanying plate (C) shows, I believe, for the first time, the external characters and colouration of the Australian species, which is now proved to range to India. In the figure the missing portions of the back-fin and flukes have been restored.

FERGUSON'S DOLPHIN (*SOTALIA FERGUSONI*).

Plate D.

Of the second specimen, which was obtained on March 31st and is quite young, the following description was supplied by the Museum :—

	Ft.	inches.
Extreme length	3	6
Length from tip of beak to origin of back-fin ...	1	5
" " " " " " " " flipper ...	1	0½
" " " " " " " " anal aperture	2	5½
Length of flipper along front curve...	0	8¾
" ". back-fin " " "	0	8½
Expanse of flukes	0	10½
Greatest girth	2	0
Height of back-fin	0	3¼

" Lower jaw not projecting. A V-shaped groove at the base of the prenarial fatty cushion.

" Body fusiform, rounded anteriorly, triangular in the middle and compressed towards the tail. Tail above and below with a prominent convex ridge marked off from the back-fin and abdomen by a concave outline.

" Colour, above dull black, sides paler, beneath dull white.

" Teeth, $\frac{32}{33}$ or $\frac{34}{34}$.

"Pterygoids divergent posteriorly.

"Ribs eleven, the first five double-headed.

"Vertebræ, C. 7; D. 11; L. 13; Ca. 18 = 49."

To this Mr. Ferguson adds that the teeth had not pierced the gum, and that the specimen probably belongs to *Sotalia.*

As regards this generic identification, I quite agree with Mr. Ferguson. In this connection it is important to notice that Dr. Blanford, in the "Fauna of British India," has transferred the Indian species included by Messrs. Flower and True in the (typically S. American fresh-water) genus *Sotalia* to *Steno*; remarking that "the differences between the Indian generic types here brought together appear to me scarcely to justify general distinction, until the skeletons are known. The typical *Sotaliæ* are estuarial or fluviatile dolphins with 51 to 55 vertebræ."

In this "lumping" Dr. Blanford appears to have considered that the separation of the pterygoids in *Sotalia* and their approximation in *Steno* were not characters of generic importance. Neither did he attach generic value to the more numerous (26—30), smaller, and smoother teeth of the former as compared with the latter, in which the number varies from 20 to 27.

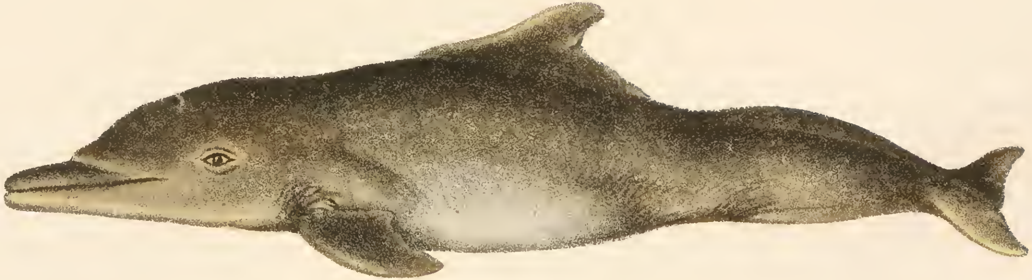
The fact that the skeleton under consideration, which belongs to a species closely allied to one of those included by Dr. Blanford in *Steno*, has the number of vertebræ even less than was previously known to be the case in any species of *Sotalia*, renders it advisable to revert to the view of Messrs. Flower and True. Nor is this all, for I find that, in addition to the separation of the pterygoids, the oriental species of *Sotalia* may be readily distinguished, at least in the young condition, by the form of the palatines. For instance, in the Trevandrum skull the palatines (*pal.*) form a kind of W-shaped band across the vomer, with a long median suture quite clear of the pterygoids (*Pt.*) A precisely similar condition obtains in the palate of *Sotalia sinensis* figured by Sir W. H. Flower (¹). On the other hand, in the palate of *Steno*, as figured by the same observer (²), the W-like form of the palatines is not nearly so marked, and there is no long symphysis of those bones below the line of the pterygoids.

The two genera may therefore be shortly distinguished as follows:—

Sotalia.—Teeth medium, smooth, and numerous (26—35). Pterygoids separate.

(¹) Proc. Zool. Soc. London, 1883, p. 487, fig. 7.

(²) *Ibid.*, p. 483, fig. 6.



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SOTALIA FERGUSONI.

Scale 1' to $1\frac{1}{2}''$

Palatines W-shaped, with a long symphysis below the pterygoids.

Vertebræ 49 to 55.

Steno.—Teeth large, rough, and less numerous (20—27). Pterygoids in contact.

Palatines not distinctly W-shaped, without a long symphysis below the pterygoids.

Vertebræ 65 to 66.

This Trevandrum specimen, then, clearly belongs to *Sotalia*, as thus restricted. From the mention of the marked constriction in the body immediately in advance of the caudal ridges (well shown in the figure), it is further evident that the species is very nearly allied to the Indian *Sotalia lentiginosa* (¹), with which it agrees very closely, if not actually, in the number of the teeth, these being given by Dr. Blanford as about $\frac{34}{35}$ in the latter. Unfortunately, nothing is known with regard to the number of the vertebræ in that species.

Sotalia lentiginosa is, however, popularly known as the speckled dolphin, from the circumstance that the body and fins are profusely spotted with elongated or pear-shaped flecks, some of which are white and others lead-coloured. No traces of such spots are visible in the Trevandrum specimen; and the question then arises, are they characteristic only of the adult condition of *S. lentiginosus*? To this question it is impossible to give a definite answer; but I am inclined to think that at least some traces of the spots would be observable in the Trevandrum specimen if it were really the young of the spotted dolphin. Moreover, the Trevandrum dolphin appears to differ from the species last-named by the much more forward extension of the part of the back-fin, which shelves off gradually into the line of the back, instead of rising suddenly. I am therefore inclined to regard the two as distinct, more especially as the colour in the sketch (although not in the description) of the Trevandrum specimen is much lighter than in the description of *S. lentiginosa*. With regard to *S. plumbea*, which has been taken at Madras, the number of teeth ($\frac{37}{34}$) is, I think, greater than could have possibly occurred in the Trevandrum specimen (of which the tip of the rostrum is slightly imperfect). Then, again, there is no white on the under surface of that species, and no mention of a sharp constriction in advance of the caudal ridges. With regard

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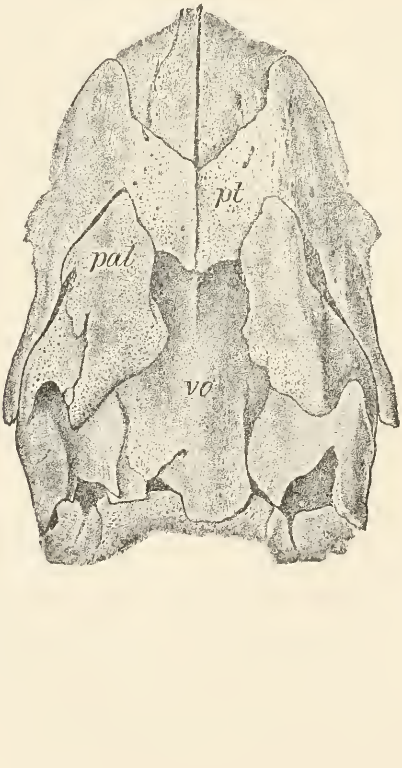
(¹) *Steno lentiginosus* of Blanford.

to Elliot's dolphin, *S. perniger* (or *gadamu*), the number of teeth ($\frac{26}{26}$) serves at once to distinguish it broadly from the present form ; and I am by no means sure (since the pterygoids are close together in the middle line) that it should not be transferred to *Steno*, in which case the dental formulæ of the two genera would be still more distinct than in the above table. The skeleton would decide the question.

From the Chinese white dolphin (*S. sinensis*) the Trevandrum form is distinguished not only by colour but by the number of the teeth and vertebræ.

On the whole, I am inclined to regard the Trevandrum dolphin as new, and I therefore propose to call it *Sotalia fergusoni*. Its special characters are the number of the teeth and vertebræ, the marked constriction of the body in front of the caudal ridges, and the generally uniform colouration, with the under-parts lighter than those above.

Specific names and characters are, however, of minor import. The real interest of the specimen consists in the information it affords as to vertebral formula of the Indian *Sotaliæ*.



THE FERNS OF NORTH-WESTERN INDIA.

Including AFGHANISTAN, the TRANS-INDUS PROTECTED STATES, and KASHMIR: arranged and named on the basis of Hooker and Baker's *Synopsis Filicum*, and other works, with New Species added.

BY C. W. WOPE.

(*Continued from page* 111 *of this Volume.*)

AFTER-WORDS.

I regret that the publication of this paper has extended over a much longer period than I anticipated; but I now recognise that this is due to the method of publication I was constrained to adopt, and somewhat, perhaps, owing to miscalculation on my part. The *Journal of the Bombay Natural History Society* has to deal with various branches of Natural History beside Botany, and the tastes of the members tend to the study of Zoology rather than to that of Botany. And I must admit that Ferns do not present the economic interest that some other branches of Botany do.

2. Parts II and III.—"New Species," and "The General List," were written in India before 1896; but they have been revised from time to time, as further material turned up, and as views came to be modified. Part I, Introductory, was written before the rest of the paper was sent to press, and a glance at it may now be taken to see how the scheme has been realised.

3. Mr. Duthie, the late Director of the Botanical Department, Northern India, continued to send me duplicates of specimens got by himself or his native collectors, and also of many contributed to the Saharanpur Herbarium by Mr. James Marten, of the Indian Forest Survey Department, collected by himself in the Chamba State, chiefly at high altitudes. Mr. Marten is a very careful collector, and his specimens are beautifully preserved. They include several rarities. Mr. Gamble also has given me many specimens collected by himself in the Jaunsar tract of the Himalaya, and by Mrs. Fisher in British Garhwál, from which latter-named district also, from low altitudes, several interesting species were brought by Inayat, one of the Saharanpur collectors, in 1902, including *Nephrodium calcaratum*, Hook., and *Acrostichum crispatulum*, Wall. The first-named of these species had been got in N.-W. India only twice before, more than 30 years ago, and the second only in West Nepal, just outside the boundary with Kumaon. It is the only *Acrostichum* in North-Western India.

4. No new books or papers on Indian Ferns have appeared, that I know of, since Part I of this paper was written ; but as two or three years before the late Sir Henry Collett's "Flora of Simla" was published I had given him a completer list than he had of the Ferns of his Simla Region, and as I found he had not dealt with the Ferns, as being beyond the scope of his "Flora," though he had hoped to do so in a separate work, I showed the list to Mr. W. Botting Hemsley, who, after Sir Henry Collett's death, was seeing his book through the press, and in his Introduction he gave the list (not here reproduced) with the following mention of the subject :—

"THE FERNS OF SIMLA."

"The Ferns of Simla are so numerous that the late Sir Henry Collett never intended to include them in the present work, but he contemplated publishing an account of them in a separate volume. He collected material for this purpose, and I have before me a list of seventy-one species collected by him in one season. As may be seen from the Bibliography at p. lxvii, several other persons have made a special study of this class of plants, and Colonel Beddome's Handbook may be mentioned as the best available work for naming the Ferns of Simla. Although descriptions could not be given, I have considered it desirable to append a complete list of the species hitherto discovered in the District of Simla. I am indebted to Mr. C. W. Hope for this list, and I present it entirely on his authority. In addition to his own very rich collection, it embodies the results of several collectors whose names are not mentioned in connection with the flowering plants. Among them are General Blair, Mr. T. Bliss, Mr. E. W. Trotter, and the late Mr. H. F. Blandford, F.R.S.

[HERE FOLLOWS THE LIST.]

"This gives a total of 124 species belonging to twenty-three genera, as against sixteen genera and thirty-seven species in the British Islands, and twenty-seven species in the county of Sussex, which has a larger area than Simla, as here understood—a rich fern flora indeed ! With the exception of the *Gramineæ* (133 species) ferns are more numerous than any Natural Order of flowering plants in the Flora of Simla."

5. In the Introduction I said that my list admitted 212 species, 16 of them being new. In the course of revision one species has dropped out and the number is now 211. The number of new species has fallen

to 15, as shown in Abstract I of the List, given above, p. 428. These new species are illustrated by 14 Plates. Besides these 15, 8 species are given in Abstract II as new to British India, and 26 species are new to the limits with which this work deals. In all 35 Plates have been given.

6. I have adhered to my resolution to give no place in my list to so-called varieties, but—when distinct enough from the so-called types to be separately described, and constant in character—to give them as species. I have, however, struck out from the list of species *Asplenium dentigerum*, Wall., and have given it as a "form" of *A. Filix-femina*, Bernh. (not *F. foemina*—as often, and in my Introduction, printed), because it varies so much in cutting, (as I came to see) that it is difficult to select any specimen of it as a type: all have a strong resemblance to *A. Filix-femina*, though there is a difference from it. Moreover, since Clarke and Beddome last wrote, typical *A. F.-femina* has been found, in 1891 and 1892, growing in several localities in Kashmir; and specimens of older date in the Kew and Saharanpur Herbariums have been recognised as typical *F.-femina*. But as typical specimens of the species have been found distributed, though sparsely, over N.-W. India, in the Himalaya, the presence of a form of it in our region is the more easily accounted for. The same change in the position of *Nephrodium Filix-mas*, as a British India fern, has happened. The researches of Harris, Trotter, McDonell, MacLeod, and Duthie have shown that the type of this species is not uncommon from Baraul eastward to the South-West of Kashmir, and that it is to be got in Chamba; and earlier specimens have been recognised as typical.

7. The figures in Plates XXVII and XXVIII will, I hope, be found to justify me in breaking up the species *Aspidium* (Polyst.) *auriculatum* into four,—it being so far as is known exinvolucrate, (or abinvolucrate) and never found in Northern India, and the other three, placed by recent pteridologists as varieties of it, being abundantly different in cutting and venation. The development of cutting, from that shown in fig. 1 of Plate XXVII to that of figs. 3 and 4, is remarkable. The broad and deeply cut form I and others had for years sorted into quite a different species, namely, *Aspidium* (Polyst.) *aculeatum*, Sw. But the venation and clothing on the under surface of the fronds—of very minute scales—seem to leave no doubt on the subject.

8. The group of *Aspidium*, hitherto placed as *A.* (*Polyst.*) *aculeatum*, Sw., and varieties, Nos. 113 to 116 of my list, cannot stand. There appears, indeed, to be no good ground for maintaining the name *A. aculeatum* any longer; and it is, in my opinion, inapplicable to any Indian plant. Continental botanists seem to use the specific name "*lobatum*" instead of "*aculeatum*"; and "*squarrosum*," Don, is an older name than "*rufo-barbatum*," Wall., for the common coriaceous shiny Indian plant. I have used the specific name "*angulare*" for the softer plants, of several different forms, which at one time I thought of setting up as *A. molle* n. sp. One of them is very near *A. angulare*, but generally with different clothing on the stipes and rhachis. The fronds of this form vary from about 1 foot to 3 feet in length, and the width sometimes exceeds 2 feet, with pinnules deeply cut into as many as ten segments. This is what Dr. Christ, in "Filicinæ, Warburg, Monsunia," calls *A. angulare*, var. *batjanensis*; but in the Dehra Dun and the Mussooree Himalaya plants of all sizes from 1 foot to 5 feet high are to be got, the length and number of segments of the pinnules increasing with the size of the plant.

9. In no case have I seen any reason to unite with the type any of the so-called varieties of *Nephrodium (Lastrea) Filix-mas.*; but I have put some of the less divergent forms under *N. parallelogrammum Kunze*. *Nephrodium odontoloma* (Moore), Bedd., (*N. F.-mas*, *var.* 2 *normalis*, C. B. Clarke), I now believe, after seeing many more specimens from the Punjab and elsewhere, to be the same as *N. pallidum*, Bory, of South-Eastern Europe and Western Asia, of which Mr. Gustav Mann was kind enough to get me authentic specimens. I have always held that this plant is quite distinct from *N. rigidum*, Desv., Mr. Clarke's No. 18, p. 323 of 'his Review.' *N. rigidum*, Desv., for which he gives as a synonym *N. pallidum*, Bory, seems to be certainly this plant. And nothing has turned up which makes me more inclined to admit any connection of *N. marginatum*, Wall. (under *Aspidum*) with *N. elongatum*, H. and Gr., or any form of *N. F.-mas.*

10. *Nephrodium prolixum*, Baker, which, reviving an old name of Willdenow's, seems to have been designed to include Kunze's two species—*N. ochthodes* and *N. tylodes* (this latter name should be *xylodes*, but Kunze himself originated the misprint), I have resolved into its original constituents; and as I found that the plant of the North-Western Himalaya, which had been called *N. ochthodes*, or *N. prolixum*,

always has a markedly creeping and branching rhizome, I have separated it as a new species—*N. repens*, Hope. An exactly similar character has led to the separation of *Polypodium* (*Phegopteris*) *laterepens* (Trotter), Hope, from *P.* (Pheg.) *distans*, Don. These two instances show the importance of ascertaining and recording the nature of the rhizome of a fern.

11. I have heard nothing but praise of the Plates by which the paper is illustrated. Owing to pressure of other work, Mr. N. E. Brown had to give up his co-operation, but fortunately I was able to get that of Mr. J. N. Fitch, a well-known artist, who had already figured many ferns, and he has very zealously and skilfully carried out my wishes. The work in Calcutta—the completion of the drawings where enlargement was not required, and lithographing the plates—has given great satisfaction ; latterly it has been very kindly superintended by Lieutenant A. T. Gage, I. M. D., who succeeded Dr. Prain as Curator of the Calcutta Herbarium.

THE FERNS OF NORTH-WESTERN INDIA.

Including AFGHANISTAN, the TRANS-INDUS PROTECTED STATES, and KASHMIR: arranged and named on the basis of Hooker and Baker's *Synopsis Filicum*, and other works, with New Species added.

BY C. W. HOPE.

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112	„ Thomsoni, *Hook.*	„	3	466
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116	„ setosum, *Wall.*	„	3	476
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160	" punctatum, *Thb.*	XV.	1	81
161	" ornatum, *Wall.*	"	"	81
162	" urophyllum, "	"	"	81
163	" proliferum, *Presl.*	"	"	82
164	" lineatum, *Colebr.*	"	"	83
165	" multitineatum, *Wall.*	"	"	83
166	" subfalcatum, *Bl.*	"	"	85
167	" amœnum, *Wall.*	"	"	85
168	" lachnopus. "	"	"	86
169	" microrhizoma, *C. B. Clarke* ...	"	"	86
170	" argutum, *Wall.*	"	"	87
171	" adnascens, *Sw.*	"	"	87
172	" stigmosum, "	"	"	88
173	" fissum, *Baker*	"	"	88
174	" flocculosum, *Don*	"	"	88
175	" propinquum, *Wall.*	"	"	89
176	" rivale, *Mett.*	"	"	90
177	" lineare, *Thunb.*	"	"	90
178	" simplex, *Sw.*	"	"	91
179	" clahtratum, *C. B. Clarke*	"	"	91
180	" membranaceum, *Don*	"	"	93
181	" heterocarpum, *Bl.*	"	"	93
182	" oxylobum, *Wall.*	"	"	94
183	" malacodon, *Hook.*	"	"	94
184	" cyrtolobum, *J. Sm.*	"	"	95
185	" Stewartii, *C. B. Clarke*	"	"	96
186	" ebenipes, *Hook.*	"	"	96
187	" juglandifolium, *Don*	"	"	96
188	" Lehmanni, *Mett.*	"	"	97
189	NOTHOCHLÆNA vellea, *R. Br.*	"	"	98
190	" Marantæ, "	"	"	98
191	GYMNOGRAMME Totta, *Schl.*	"	"	98
192	" Levingei, *Baker*	"	"	99
193	" vestita, *Hook.*	"	"	100
194	" Andersoni, *Bedd.*	"	"	100
195	" javanica, *Bl.*	"	"	100
196	" leptophylla *Desv.*...	"	"	101
197	" involuta, *Hook.*	"	"	102
198	" elliptica, *Baker*	"	"	102
199	VITTARIA, lineata, *Sw.*	"	"	103
200	ACROSTICHUM virens, *Hook.*... ... ... = A. crispatulum, *Wall.*	"	"	103
201	OSMUNDA Claytoniana, *L.*	"	"	103
202	" regalis, "	"	"	103
203	LYGODIUM microphyllum, *R. Br.*	"	"	103
204	" pinnatifidum, *Sw.*	"	"	105
205	" japonicum, "	"	"	105

Serial No.	NAMES.	Volume of Journal.	Number in Volume.	Page of Volume.
206	OPHIOGLOSSUM lusitanicum *L.*	XV.	1	106
207	„ vulgatum „	„	„	107
208	BOTRYCHIUM lunaria, *Sw.*...	„	„	108
209	„ ternatum (Thb.) *Sw.* or B. obliquum, *Muhl.*	„	„	108
210	„ virginianum, *Sw.*	„	„	109
211	„ lanuginosum, *Wall.*	„	„	110

ABSTRACT I.—List of New Species.

Serial No.	NAMES.	Volume of Journal.	Number in Volume	Page of Volume.
1	Davallia Beddomei, *Hope,* Plate I ...	XII.	3	527
2	Cheilanthes dubia, „ „ II ...	„	3	528
3	Onychium contiguum, *Hope,* *Nil.* ...	XIII.	3	444
4	Asplenium tenellum, „ Plate IV ...	XII.	3	529
5	„ rupicola, „ „ V ...	„	3	531
6	Aspidium Duthiei, „ „ VI ...	„	3	532
7	Nephrodium Gamblei, *Hope,* „ VII ...	„	3	533
8	„ repens, „ „ VIII ...	„	3	535
9	„ Kingii, „ „ IX ...	„	4	621
10	„ serrato-dentatum, *Hope,* (double plate) „ X ...	„	4	622
11	„ pandum, *Hope,* *Nil.* ...	„	4	623
12	„ Blanfordii, Plate XI ...	„	4	624
13	„ Papilio, *Hope* „ XII ...	„	4	625
14	„ occultum „ „ XIII ...	„	4	627
15	Polypodium late-repens (Totter), *Hope,* XIV ...	„	4	628

ABSTRACT II.—Species New to the British Indian Region.

Serial No.	NAMES.	Volume of Journal.	Number in Volume.	Page of Volume.
1-15	NEW TO SCIENCE.—See Abstract I.			
16	Davallia Wilfordii, *Baker*—Plate *nil*	XIII.	1	33
17	Pteris digitata, *Wall*	„	3	453
18	Asplenium Filix-femina, *Bernh.* (type) ...	XIV.	1	124
19	„ squamigerum, *Mett.*	„	2	259
20	Aspidium luctuosum, *G. Kunze*	„	3	475
21	Nephrodium Filix-mas, *Rich.* (type)	„	4	727
22	Opioglossum, Lusitanism	XV.	1	106
23	Botrychium virginianum, *Sw.* (type)	„	1	109

ABSTRACT III.—Species New to the N.-W. Indian Region.

Serial No.	NAMES.	Volume of Journal.	Number in Volume.	Page of Volume.
15	NEW SPECIES :—Abstract I.			
8	NEW TO THE INDIAN REGION :—Abstract II.			
	NEW TO N.-W. INDIAN REGION :—			
1	Trichomanes pyxidiferum, *L.*	XIII.	1	26
2	Onoclea orientalis, *Hook.*	„	1	27
3	Sphæropteris barbata, *Wall.*	„	1	28
4	Onychium auratum, *Kaulf.*	„	3	443
5	Pteris dactylina, *Hook.*	„	3	451
6	„ ludens, *Wall.*	„	3	456
7	Blechnum orientale, *L.*	„	3	459
8	Asplenium exiguum, *Bedd.*	„	4	663
9	„ tenuifolium, *Don.*	„	4	667
10	„ drepanophyllum, *Baker*	„	4	668
11	„ tenuifrons, *Wall.*	XIV.	1	120
12	„ Filix-femina (type), *Bernh*	„	1	124
13	„ multicaudatum, *Wall.*	„	2	263
14	Aspidium luctuosum, *G. Kunze.*	„	3	475
15	Nephrodium hirtipes, *Hook.*	„	4	721
16	„ gracilescens, *Hook.*	„	4	722
17	„ calcaratum „	„	4	723
18	„ odontoloma, (Moore) *Bedd.*	„	4	736
19	„ setigerum, *Baker*	„	4	744
20	Nephrolepis volubilis, *Smith*	„	4	748
21	Polypodium adnascens, *Sw.*	XV.	1	87
22	„ Lehmanni, *Mett.*	„	1	27
23	Gymnogramme elliptica, *Baker*	„	1	102
24	Lygodium microphyllum, *R. Br.*	„	1	105
25	Ophioglossum vulgatum, *L.*	„	1	107

DESCRIPTIONS OF THREE NEW FROGS FROM SOUTHERN INDIA AND CEYLON.

By G. A. BOULENGER, F.R.S., V.P.Z.S.

With a Plate.

(*Read before the Bombay Natural History Society on 5th November* 1903.)

RANA AURANTIACA.

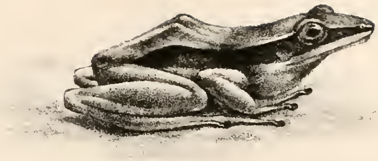
Vomerine teeth in two oblique series between the choanæ. Head depressed, longer than broad; snout obtusely pointed, a little longer than the orbit; canthus rostralis distinct; loreal region nearly vertical, concave; interorbital space a little broader than the upper eyelid; tympanum very distinct, three-fourths the diameter of the eye. Fingers rather slender, first extending slightly beyond second; toes two-thirds webbed; tips of fingers and toes dilated into small but very distinct disks; two small metatarsal tubercles. The tibio-tarsal articulation reaches between the eye and the tip of the snout. Skin smooth; a narrow glandular dorso-lateral fold. Orange above, without spots on the back or bars on the limbs; a black lateral band on each side of the head and body; upper lip, canthus rostralis, and dorso-lateral fold white; terminal disks of toes black; lower parts white.

From snout to vent 38 millim.

A single specimen of this pretty frog, allied to *R. temporalis*, Gthr., was found on a bush near Trivandrum, Travancore, by Mr. H. S. Ferguson. A coloured cast of the frog was made by Mr. Ferguson, whilst the specimen itself, rather poorly preserved in spirit, has been kindly presented by him to the British Museum.

RHACOPHORUS PLEUROTÆNIA.

Vomerine teeth in two very small groups close together between the choanæ. Snout rounded, a little shorter than the diameter of the orbit; canthus rostralis obtuse; loreal region slightly concave; nostril nearer the end of the snout than the eye; interorbital space broader than the upper eyelid; tympanum moderately distinct, not quite half the diameter of the eye. Fingers with a slight rudiment of web; toes half-webbed, the web very short between the inner toes; disks a little smaller than the tympanum. The tibio-tarsal articulation reaches the posterior border of the eye. Upper parts with fine vermicular rugosities; belly and lower surface of thighs with large flat granules. Brown



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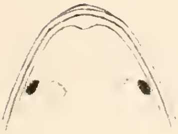

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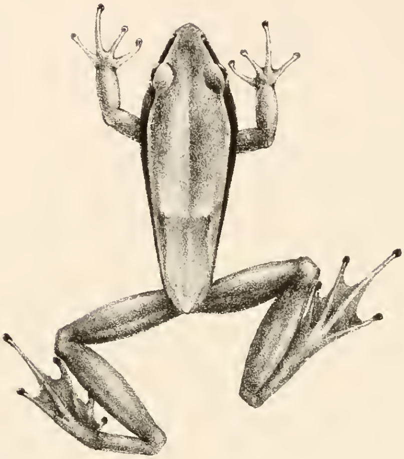

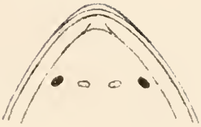

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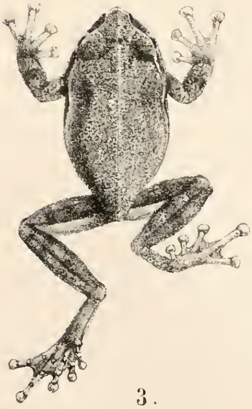

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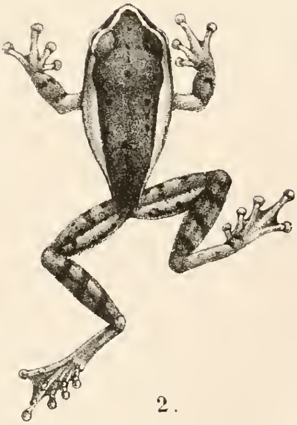

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NEW FROGS FROM SOUTHERN INDIA AND CEYLON.

1. Rana aurantiaca. 2. Rhacophorus pleurotænia. 3. Ixalus halyi.

above (in spirit), with a broad, white, black-edged band on each side, from the eye to the groin, continued as a narrow streak on the edge of the upper eyelid and on the canthus rostralis, joining its fellow on the tip of the snout; sides of body and thighs with black dots; limbs with regular dark cross-bars; lower parts white, with a few small black spots on the throat.

From snout to vent 27 millim.

A single specimen from Kandy, received from Mr. Haly, late Curator of the Colombo Museum. *R. microtympanum*, Gthr., is the nearest ally of this new species.

IXALUS HALYI.

Snout rounded, a little shorter than the diameter of the orbit; canthus rostralis distinct; loreal region slightly concave; nostril a little nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum distinct, rather more than half the diameter of the eye. Fingers free, toes half-webbed; disks well developed, a little smaller than the tympanum. The tibio-tarsal articulation reaches the eye. Upper parts rugose; a raised ridge along the vertebral line, crossing another on the interorbital region; a strong fold from the eye to the shoulder. Throat, belly, and lower surface of thighs coarsely granulate. Reddish-brown above, with ill-defined darker markings on the head and body and cross-bars on the limbs; loreal region dark-brown; sides and lower parts white. Male with an internal vocal sac.

From snout to vent 28 millim.

A single specimen from Pattipola, Ceylon, received from Mr. Haly, after whom the species is named.

THE PRESENT POSITION OF ECONOMIC ENTOMOLOGY IN INDIA.

BY

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Lately Entomologist to the Imperial Department of Agriculture for the West Indies.

(*Read before the Bombay Natural History Society on 17th December* 1903.)

1. Introduction.
2. Economic Entomology.
3. Entomology.
    - *a.* Systematic.
    - *b.* Life History and Habits.
    - *c.* Checks.
    - *d.* Morphology, etc.
    - *e.* Insects and Plants.
4. Agriculture.
5. Mechanical.
6. Indian Conditions.
7. Conclusion.

1. INTRODUCTION.

In this paper I propose to discuss the progress made in the study of Economic Entomology in India and the point to which this subject has been carried. This is a somewhat large subject to discuss in detail, and I have endeavoured to bring into a small compass a review of our present knowledge and a clear statement of the legitimate aims of the economic entomologist. It is necessary to have clearly in mind what are the purposes and objects of this branch of science; how it is related to Entomology as a whole, its bearing towards agriculture and commerce, its place both in the scientific world and in relation to ordinary human activities. We shall then be in a position to see what progress has been made, where we stand in relation to allied branches of science and finally the probable lines of future work. I touch this last point with great diffidence; my own work is clearly before me and I have no wish to be considered as laying down lines of work before a critical audience of entomologists. I would gladly plead for a greater interest in this subject for help from the members of this Society; but this is my first appearance before a Society to whom I am wholly unknown, and I hope that if any feel drawn to this work they will have no difficulty in finding a subject and no hesitation in undertaking it.

2. ECONOMIC ENTOMOLOGY.

Economic entomology is a branch of knowledge resting on the one hand on pure entomology and on the other on agriculture and commerce.* It may be defined as an endeavour to control all insect activities that affect the welfare of man, either beneficially or harmfully; it is an applied science, an adaptation of "pure" entomology to the needs of agriculture and commerce.

Primarily its aim is practical, to obtain visible results either in the reduction of loss sustained from harmful insects or a commercially valuable increase in the useful products derived from insects. This aim will be attained by the scientific or theoretical study of the subject, the investigation of the laws that govern insect increase, of the conditions under which insects thrive. Its secondary aim therefore is to accumulate that scientific knowledge, which though not in itself directly valuable, does eventually lead to improved practical methods.

It will be said that I have put the cart before the horse; but we must remember that the purely scientific work has to some extent been done; there is a basis of knowledge on which to commence practical applications and the latter work is far behind the progress made in some branches of pure entomology. For us now the practical work is the primary object; if there were more workers, we could carry both on hand in hand, but entomologists do not extend their researches to the problems that beset the economic worker, and the latter must, from his isolation, confine himself to pushing on the immediately useful work before him. Economic entomology is a modern development due, not to science, but to the urgent needs of agriculture; it is from the very scanty number of workers far behind other branches of entomology, and those who work in it find that the basis of directly useful knowledge has to be laid to the exclusion of such scientific work as has not some immediately tangible result. This is especially the case in India; I draw attention to it, not because I think lightly of entomology that is not economic, nor because I see an overwhelming mass of purely practical work before me, but in the hope of drawing attention to the many problems that underlie practical work, which are in themselves pure entomology. It is here that the naturalist who is neither a rabid systematist nor an economic entomologist can find such a large and absorbingly interesting field ; I mean in problems connected with insect increase, with parasites and predators, with plant-immunity to insect attack, with the "balance of life" and so on. Between the systematist on the one hand and the economic entomologist on the other, there is this vast field of work, a domain as yet scarcely touched, which should justly be occupied by the ordinary, I may perhaps say "amateur," naturalist.

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* Forest Entomology, a branch of Economic Entomology, is not included in the subject of this paper. Its aims are slightly different and it would be an additional complication in a paper which is already quite sufficiently involved.

We may then regard economic entomology as a branch of entomology, strictly a narrow branch intent on practical results, far removed from the systematic work that makes up so much of modern entomology, comprising also a part of agriculture and a branch of knowledge peculiar to itself. It is concerned not only with the insects that injure the crops, but also with the crops themselves and with the mechanical methods of destroying insects on a large scale. There are three distinct branches. Entomological, Agricultural and Mechanical. One without the other is useless. The ways and habits of the insect come first, then the conditions under which the crop grows, and with these two, one or more special methods can be applied.

I propose to discuss these in order, to see as far as possible where we stand in each and we can then see in which directions progress in the whole subject is likely to be made.

3. ENTOMOLOGY.

A.—Systematic.

I have placed this first, not because it is of first-rate importance, but because it includes the greater part of modern entomology. For the economic entomologist, names and nomenclature are a necessary evil ; before looking up literature, and before going into print, one must have the names of the insects concerned. To facilitate this ready naming, a good deal of purely systematic work has to be done, especially in the little-known groups ; but this ought not to be ; we should be able to look to entomologists for this class of work, instead of having as at present, to do it as best we can ourselves or rely on Continental specialists.

In this department of knowledge, considerable progress has been made and there is more known on this point than on any other. But even here the economic entomologist will get little real help.

In the Fauna of India series, there are volumes on Moths, Bees, Wasps, Ants and Ruby Wasps, and *Rhynchota* (chiefly *Pentatomidæ*).

Volumes in preparation are Butterflies, Longicorn *Coleoptera*, and further *Rhynchota*.

Other books deal mainly with *Lepidoptera*. Miscellaneous papers in the proceedings of learned societies deal with haphazard collections of other groups, but there is little of a thorough nature. In the journal of this Society, thirteen authors write on Butterflies, three on Moths, three on *Formicidæ*, four on other *Hymenoptera*, one on *Rhynchota*, two on *Culicidæ* and one on a single family of *Coleoptera*.

We may sum up by saying that the butterflies are known well, the moths moderately, other groups little or not at all.

This is distinctly unfortunate; of all groups none are of so little importance in agriculture as the butterflies; the economically important moths *Noctuidæ*, *Pyralidæ*, *Tineidæ*, are not as well known as other family of moths; the *Coleoptera*, small *Hemiptera*, *Diptera* are almost unknown. How does this affect economic work? It means that the difficulty of identifying economically important species is much increased. We cannot rely on entomologists in India, on collections in India, or on the literature of Indian insects in order to identify our pests. It is a small difficulty and brings with it the additional fact that until the systematic work is widened, we shall be wholly in the dark as to any generalisations on the facts of geographical distribution in India.

The present tendency in India to work solely on the butterflies or the larger moths is distinctly to be regretted; if systematic work is the aim of entomologists, that whole branch would progress were the work fairly divided. Of the twenty-five writers on entomology in this journal, thirteen were concerned with butterflies and three with moths; of the rest, only five are entomologists working in India. So long as this continues, a mediæval darkness will reign supreme over all but the *Lepidoptera*, and economic entomologists must rely, as now, on the British Museum officials or on Continental entomologists.

B.—*Life History and Habits.*

The first essential in economic work is to be familiar with the life history and habits of the injurious insects; it is the entomological basis of useful work, the paramount point. At present there is little help to be obtained from literature or from the work of naturalists in India. The facts regarding insect life histories in other countries do not apply to India ; it is all new work. On the whole there is a profound darkness in this subject too, illumined here and there by a really thorough piece of life history work : something is known of the *Lepidoptera*, because good specimens have to be bred : but this is by no means clear or complete, being based more on specimens reared in captivity than on specimens breeding freely in the field. I may instance the importance of this work by two cases : the Bombay Locust (*Acridium succinctum*) is one of our commonest insects ; we are yet in doubt whether it has two broods in a year or one, and the simplest facts of its life history are unknown. The moth borer (*Chilo simplex)* which attacks cane, corn, juari, etc., was *believed* to lay eggs on the cane and was *believed* to breed throughout the year. The eggs have been found for the first time this year, and we have just found that the caterpillar hybernates in the cold weather and so does not continue breeding.

As I said before, butterflies are not economically important, so the life history work done in this group does not help us : in other groups, save for an occasional insect, we know little accurately, and the most urgent need at present is in this line. Habits and habitat, again, is an unknown subject. We know that this pest is aquatic, that one lives in stems, that another makes galls, but nowhere is there any consecuting account of the aquatic insects, of the stem-boring insects, of the gall makers. I would like to see work done in this line, naturalists working at all insects that live in a particular habitat ; pond life and aquatic insects, the gall insects, the scavengers, the predators, the various groups of parasites, the social insects, there are numbers of extremely interesting groups. The only papers of this kind I can recall are Mr. Wroughton's and Mr. Rothney's on " Our Ants " published in this journal. I think one cannot easily overrate the importance of such work to the economic entomologist ; daily he is confronted with questions, and it seems to be useless to turn to the literature for any help. It is perhaps in this branch that we may look to the ordinary working naturalist, who cannot devote many hours to the subject, for help ; I should be very glad if anything I could do would rouse an interest in this among members of the Society.

C.—*Checks.*

I have placed in one section all those questions that turn on the relations of one species to another, the problems of parasites, predators, natural checks on excessive increase of a species. I believe I am correct in saying that a complete study has never been made of the foes of any one Indian insect; we know little or nothing of the predaceous and parasitic insects of this country. They are of profound importance in regulating the increase of destructive insects; they are bred from all sorts of insects or are found feeding on them. A study of any group of parasitic or predaceous insects would yield most interesting results. We have much to learn before we can determine whether there is any way of influencing them, of aiding them, or of controlling them in their useful work. Some years ago the coffee planters of South India sent a man to Australia to find beetles to eat the coffee scales; they were not successful and I think any one who had studied the question could have given them better advice and spared their pockets.

I include here all those problems that are concerned with the "balance of life" and kindred phenomena. It is one of the ideals of economic entomology to control the injurious insects by maintaining the balance of life, by preserving the balance between the parasite and its host, the predator and its prey. It is because that balance is upset that some species are able to increase so enormously and so rapidly. I cannot enter into this question; it demands a paper to itself. In time we shall perhaps be able to work up to this ideal condition or to at least understand something of it. The preliminary will be a study of these predatory and parasitic insects, of insectivorous birds, lizards, bats, etc. At present there is an almost clear field in this section.

D.—*Morphology, etc.*

We may group together Morphology, Physiology, Embryology and allied subjects in one section, as of little direct importance. We cannot say of no importance; a study of the digestive processes of caterpillars, locusts and other plant-eating insects would possibly yield valuable results. We use arsenic in various forms as a stomach poison, because we know, it *does* poison insects; I suppose it was first tried on account of its effects on the higher animals. There is reason to believe that other compounds, innocuous to ourselves, would prove poisonous to plant-eating insects if we understood the physiology of digestion and could act on that knowledge. Still, this is a bye path, a difficult piece of research that can more profitably be taken up when the less difficult work is done and which might, after all, yield no practical results. For some time to come we can neglect these difficult problems with the satisfactory feeling that they do not immediately concern us. Equally I leave on one side all those problems concerned with colour and form, with Mimicry, Warning and Protective Colouration, Natural Selection, the Inheritance of Acquired Characters, etc.; such subjects are full of interest, but it does not assist us to know whether protectively coloured forms have become so by natural selection and the survival of the fittest, or by directer means. This is a subject worthy of the attention of this Society, but they do not immediately influence the problem of controlling injurious insects.

E.—Insects and Plants.

Lastly we may group together under one head all those questions that arise in connection with the food of insects, for us especially the plants they feed on. We are here concerned as much with botany as entomology. To commence with the simplest facts, we are still ignorant of what insects will feed on even our common plants; there is a good deal of scattered information, notably in "Indian Museum Notes," and I find a list of 150 species can be made up from that publication which are known to attack particular plants, mostly crops. With the help also of the various reports and other Government publications, and of the volumes on *Lepidoptera*, etc., a fair basis can be made of the bare facts.

When we look deeper into the question, again we find nothing definite on record. We still have no idea of what governs an insect's choice of food plants, whether the food plants vary with the seasons, why some species have a large range of food plants, whilst others are limited to one or two. This is important in all plant-feeding insects, but especially in the sucking insects, *Coccidæ*, *Aphidæ*, etc.

On the botanical side we touch a very large subject in the means of protection adopted by plants against insects, in the relation between vitality and disease, and in the question of immunity from certain forms of insect attack. I may refer you to a suggestive paper in this Journal (Vol. II, No. 4, p. 232,) by Dr. D. Dymock, entitled "The Means of Self-Protection Possessed by Plants." These problems are largely botanical, and since botany is not swamped by systematic work, we need not look in vain for information. But we do surely need actual lists of the insects that will feed on our common plants, or, if you prefer, of all the food plants of each of our common insects.

I have not mentioned any of those questions connected with insects attacking stored grain, timbers, etc., *i.e.* insects that do not feed on plants. This would needlessly complicate this paper, as their importance is secondary to the pests of crops.

I have in a very hasty and imperfect manner reviewed our position in Entomology ; I have intentionally brought up those branches that are of greatest importance to the economic entomologist and omitted very much in my incomplete division of the subject.

It is now necessary to turn to the allied subjects which are involved in the whole question, before we can review our position.

4. AGRICULTURE.

The condition of agricultural science will largely determine our position in economic entomology and it is refreshing to have to deal with a science that stands at a high level of proficiency. The crops of this country are known and studied, botanically as well as agriculturally ; so far as our work carries us into agriculture, there is no lack of information. Not only information, but facilities in the way of trained men on the experimental farms where the crops are grown and studied with a view to finding the best conditions for them. We do not need to go deeply into the problems of agriculture ; our need is rather that of reliable information concerning the usual agricultural practice ; so far as the entomological affects and is affected by the agricultural, we are on sure ground.

It is generally not realised how large is the effect of the "agricultural" side in the treatment of insect pests ; it is a common belief that once an insect is known, and its life history worked out, the best methods for dealing with it must necessarily follow from that knowledge, independently of the way in which the crop is grown.

That is not so ; a remedy is good in proportion as it is adapted to the crops and to the conditions under which that crop is grown. A large portion of the practical work consists in adapting standard methods to the existing agricultural practice, or in modifying that practice so as to influence some insect pest.

Many fine remedies are thought of when an insect pest is studied in the laboratory, which are useless when tested in the field ; unfortunately these remedies look so good on paper that they are only too often published, and it is just this class of work that makes planter and cultivator smile and wonder that any one troubles with a science that leads to such absurd and impracticable results. I venture to say that no remedy is likely to be of much use unless it is based on the agricultural practice under which the crop is grown ; very few are good until they have been actually worked out in the field.

We may rate the agricultural knowledge as being of very high importance, and the most satisfactory feature of the present position is that here we have no difficulty and do not have to work up this subject.

5. MECHANICAL.

Finally we come to the question of the actual remedies used in fighting insects on a large scale. How are insects to be killed on a large scale ? Answers to this question have been developing during the last half century, and there is a large mass of literature dealing with wholesale poisoning or destruction of pests. These methods will need to be modified for use in India and, save in the one instance of the migratory locust, I know of no trials of even the simplest methods in this country. I believe I am justified in saying that we have here a clear field with no basis of experiment to go on and all our work before us. The question is too large to deal with in detail ; every remedy we *think* may be good has to be adapted to Indian conditions ; it has to be modified to suit different places, to be rendered available to the untrained cultivator and to the trained farm assistant. We have to learn how best to use the raw materials obtainable in this country, how to distribute insecticides, what machinery is suitable for India. I do not doubt of progress ; though we have no previous experiments to guide us, we are unhampered by any defective methods or erroneous ideas. Years of work are required, but that work is already begun and gives promise of rapid progress.

This branch is so far removed from Natural History that I do not propose to dwell on it longer ; if naturalists turn their attention to our problems, it will, I hope, be to the scientific rather than to the practical. The latter will be worked out on the Government farms and in the field ; it is work suited to men engaged in experimental agriculture, and our difficulty will lie, not in solving this problem, but in pushing forward the much more difficult scientific work.

6. INDIAN CONDITIONS.

We have briefly reviewed our position in all that concerns economic entomology in itself, but our review is not complete until we have glanced at the nature of the problem before us, the peculiar conditions we meet with in the course of our work.

I think we are justified in assuming that the problem before us is a small one compared with that of some other countries. Relatively to the size of India, to the area under cultivation, and to the value of the crops grown, the ravages of insect pests appear to be small. Why is this? A complete answer cannot be given as yet, but some very obvious reasons present themselves. Climatic conditions must greatly influence insect increase: the long dry season, the variations in temperature, the heavy monsoon rainfall, these are not favourable to insect increase.

I believe that an equable warm climate with well-distributed rainfall, such as obtains in the West Indies, is far more favourable to the rapid increase of pests than is the Indian climate. The variety of Indian climatic physical features favours the multiplication of species, not the enormous increase of any one species. A second important factor is the variety of crops, not only a variety in different parts of India but a variety in every place and at different seasons of the year. The practice of growing different crops in the dry season to those of the wet season, with the fact that for some time there may be no crops save those under irrigation, must make the increase of a pest very hard. The migratory locust certainly is an exception, perhaps because of his omnivorous food habits and migration over large distances.

I think we may confidently attribute a great deal to these facts and we may add a third of almost equal importance—the pests have not been introduced. Wherever insect pests are studied, the introduced species rank amongst the worst if they do not make up a great proportion of them. The United States shows this very clearly; and in the West Indies, of the worst insect pests, the *Coccidæ*, two-thirds of the very destructive species are introduced. There is not time to enter into this question in detail; a perusal of the reports of entomologists, particularly of those in the United States, will show what importance is attached to this point.

On the whole we may fairly consider we have a good deal in our favour, a distinct natural advantage from the peculiar conditions of the country. Let us look at the other side, what we have against us. There are extraordinary difficulties inherent in the nature of the country and the people; the great area to be worked over, the isolation of the cultivators and the crops, the ignorance and complete lack not only of knowledge but of desire to alter the natural state of things, these difficulties are very great. The very forces that check the insects check also any attempt to maintain an equable balance of life : the change of seasons, the rotation of crops, the isolation of all districts not on a railway, will make the matter very hard, simply from the difficulty of getting news of an outbreak of disease in time to get to the spot and test remedies. This sounds a small difficulty, but so much depends on starting remedies before the pest has got a good hold that it becomes a very real one. It will assuredly not be an easy matter to bring remedies within reach of the cultivator, to whom every new thing is necessarily bad and to whom every anna spent is a serious consideration.

We may justly balance these considerations and realise what our difficulties are at the outset; patient work will meet these difficulties just as a careful study of the climatic and other helps will show us whether we can turn them to advantage and check the increase of insect pests without having recourse to artificial remedies.

7. CONCLUSION.

We are now in a position to review the subject in all its aspects and I have tried to summarise what I have very inadequately dealt with above. Our problem is to control the harmful and beneficial insects in this great country, where agriculture is the source of prosperity and where extraordinary conditions of climate, agriculture and people fight for and against us. We are hampered from the beginning by the work of merely identifying our insects; we have then to work out life-histories and habits, to learn the exact effect of climate, the importance and influence of predaceous and parasitic insects; also we have to gather and tabulate information regarding the food plants and geographical distribution of our common insects. In all of these points we have a narrow basis of ascertained fact to go on, particularly in regard to systematic work and the question of food plants.

As far as the wider problems are concerned, which lie at the base of the whole question, we have as yet nothing but a small mass of isolated facts.

In regard to the crops and the agricultural conditions, there is a sufficient amount of established knowledge to meet all our needs; when we come to actual methods of checking injurious insects, we have a practically clear field with all our experimental work before us and only the experience of entomologists abroad to guide us.

So far as the actual work of dealing with individual pests goes, we may hope for steady progress, simply by taking them one by one and working them out; this is a question of time. As regards the general problems I cannot see any hope of advance. The basis of fact must first be laid, the important families studied; the wider problems can then be tackled on a broad basis of established fact which we have not as yet got.

When all our scattered information is brought together, we shall be little the wiser and only patient work on broader lines can raise the general level of the subject.

This paper would be complete if I were able to lay down the lines on which work could best be carried on; from the very nature of the problem I cannot do so. I see vast fields of work, some more pressing than others, in all of which any one can increase our knowledge. On the other hand I see little hope of attracting naturalists into these fields. So far as I personally am concerned, my way is clear: I can only do what lies to hand; the investigation of the important pests, the working out of life histories, the devising of remedies, the work of bringing these remedies to the hands of cultivators, these must absorb my energies and those of my staff. Perhaps something will be possible in the way of collecting our scattered knowledge into handy shape and I should be glad if I could give any help to anyone working in this subject.

If I may make suggestions, I would urge that naturalists should think whether they cannot direct their knowledge and energies to one of the many problems near at hand. To systematists, I would suggest the important families of beetles (*e.g.*, *Chrysomelidæ*, *Curculionidæ*, *Scarabæidæ*, *Coccinellidæ*,) or the smaller *Hemiptera* (*Lygæidæ*, *Coreidæ*, *Psyllidæ*, *Aphidæ*) or the *Diptera*.

Those who are attracted by life-history work will need no suggestions. An accurate life history over the whole year of one insect in each of the important groups would give us a good working basis.

There are hosts of general problems—the parasites, the galls, the predatory insects, the scavengers, the insects underground, etc., in all a clear field and the certainty of adding new facts to science. The study of any one family or tribe, not systematically only but including life histories, distribution, habits, enemies, etc., must add greatly to our knowledge.

Perhaps you will think I am too ambitious ; there is room for every one and the study of even one species in all its branches will advance our knowledge and be a work no naturalist need hesitate to undertake. Clearly there is abundance of work and a grand field for every worker. There are no lack of facilities for publishing and there is a large body of people to take an interest in the work as the membership of this Society shows.

A NEW TERMITE FROM INDIA.

DESCRIBED BY J. DESNEUX (BRUSSELS).

(*Read before the Bombay Natural History Society on 21st January* 1904.)

TERMOPSIS WROUGHTONI, n. sp.

Winged form. Upperside yellowish-brown; head and prothorax darker, reddish-brown.

Head rounded, flat. Eyes large, almost reniform. Ocelli totally absent.

Antennæ longer than head and prothorax, of 24 segments; first segment longer than 2nd, third segment shorter than 2nd.

Prothorax narrower than the head, lateral sides depressed.

Cerci long, of 6 segments. Abdominal papillæ long.

Tarsi furnished with a plantula.

The wings venation is that of *Termopsis*, notwithstanding some difference.

The costal area is on the whole similar, but while the mediana of *T. angusticollis*, Hagen, of California (the only one living known species of this genus, of which the winged form is described) is nearly straight from base to apex, the mediana of our species is distinctly curved, and the greatest distance between it and the subcosta lies near the middle of its curve.

The submediana is far longer than it is the case with *T. angusticollis*, and the number of the veins it emits is also greater.

The veins are almost invisible, with exception of the costal branches, and of the basalbranches springing from the submediana, which are distinct.

Length of the body: 11 mm.

Length and width of anterior wing: 19 × 5, 5 mm.

Soldier: Robust. Head rectangular, reddish-brown, anterior portion darker; mandibles black.

Eyes present, small, ovoid, black.

Left mandible furnished with a very strong tooth.

Mesothorax and metathorax furnished with rudiments of wings similar to those which Hagen describes and figures for the soldier of *Termopsis occidentis* (V. Linnæa Entom. XII, p. ff, pl. 1, f. 8).

A peculiar character of this soldier is the exceptional size of the cerci which are much longer than in any other known Termite, and which give to the posterior part of this soldier some resemblance with that of an earwig.

Length : 15 mm.

Hab : Kashmir Valley. (Rob. C. Wroughton ; June 1903).

I take much pleasure in naming this species after Mr. Wroughton who was so good as to collect for me these interesting specimens, which I received together with a few other white-ants through the kindness of the Hon. Secretary of the Bombay Natural History Society.

The discovery of a *Termopsis* in India is of the highest interest.

This genus was hitherto only represented by two species inhabiting California and Central America and by two fossil species from the amber of Œningen (Prussia).

The foregoing description is but a preliminary note. The specimens collected by Mr. Wroughton were rather damaged when they reached me, and an examination of new specimens will enable me to give a complete and definitive description of *Termopsis Wroughtoni.*

THE COLOURATION OF BIRDS' EGGS.

By D. Dewar, I.C.S.

(Read before the Bombay Natural History Society on 21st January 1904.)

A well-known naturalist has declared that he knows of no more inspiriting subject than the colours of birds' eggs.

"The most superficial glance over a collection," he writes, "reveals hosts of interesting problems which require solution." Nevertheless, I know of no portion of natural history which is in so unsatisfactory a state as that relating to the colouration of birds' eggs.

Since the fowls of the air are the direct descendants of the reptiles, and these latter mostly lay white eggs, it is generally supposed that the eggs of the most primitive birds were white.

Three theories have been advanced to account for the fact that so many eggs are now coloured.

According to one this colouring matter is useful to the species in that it protects the contents of the eggs from the rays of the sun.

On the second hypothesis, which at present holds the field, colour has arisen in eggs in order to cause them to resemble their environment and thus afford them some protection from egg-eating birds and beasts.

The third theory asserts that the colouring of birds' eggs is determined by the influence of the surrounding tints upon the retina of the female.

In favour of the first theory is the indisputable fact that excessive light is injurious to protoplasm. There is also the fact that most of the eggs which are laid in dark holes and caves are white.

The theory is, however, confronted by a number of insuperable difficulties. Many birds—as, for example, ducks, grebes, pheasants, pigeons and doves—which do not nest in dark places, lay white eggs. It is certainly true that some of these birds have the habit of covering up the eggs when they leave the nest and thus protecting them from the sun's rays. But many birds do not take this precaution.

Again, many birds which nest in dark holes do not lay white eggs.

Reptiles' eggs are exposed to the hottest sun, yet they are usually not coloured.

Further, if eggs were coloured with the object of protecting the contents from excessive light, we should expect eggs laid in tropical climates to be more darkly coloured than those found in cold countries. There is no such relationship between climate and colour.

Lastly, if eggs were coloured merely with the object of protecting the contents from light we should expect the colouring matter to be uniformly spread over the egg, or, at any rate, to be laid on more thickly on the exposed surface. This theory totally fails to account for the pencillings and other markings which occur on eggs.

The theory that colour protects eggs from living enemies accounts for the colouration of some eggs, but not of others. I think it sufficiently explains the colours of those eggs which are laid in the open and not provided with the protection of a nest. Such eggs, in many instances, very closely resemble their surroundings. On this subject I cannot do better than quote Dixon, who writes: "The common sandpipers' eggs assimilate so closely with the tints around them as to make their discovery a matter of no small difficulty, as every oologist can testify who has searched for them. The pewits' eggs, dark in ground colour and boldly marked, are in strict harmony with the sober tints of moor and fallow, and on this circumstance alone their concealment and safety depend. The divers' eggs furnish another example of protective colour; they are generally laid close to the water's edge, amongst drift and shingle, where their dark tints and black spots conceal them by harmonising closely with the surrounding objects. The snipes and the great army of sandpipers furnish innumerable examples of protectively coloured eggs. In all the instances given, the sitting-bird invariably leaves the eggs uncovered when it quits them, and consequently their safety depends solely on the colours which adorn them."

I trust I shall be pardoned for quoting at length so well-known a passage, but I wish particularly to contrast it with another which I shall later have occasion to quote.

It seems to me that this protective theory explains most satisfactorily the colouration of eggs which are laid in the open. On the other hand, I maintain that it utterly fails when applied to eggs which are laid in nests. Take any instance of a common Indian bird which lays in a nest in a tree and I think that no impartial person will be prepared to maintain that their eggs are coloured so as to be inconspicuous in the nest. Could anything be more conspicuous than a clutch of bulbul's eggs in a nest? Naturalists have to admit that eggs in nests do look conspicuous to us, but the adherents of the protective theory hint that we examine them too critically. Lest I be accused of doing this school of naturalists injustice, let me quote from one of the greatest of them—A. R. Wallace.

He writes : "The beautiful blue or greenish eggs of the hedgesparrow, the song-thrush, the blackbird, and the lesser red-pole seem at first sight especially calculated to attract attention, but it is very doubtful whether they are really so conspicuous when seen at a little distance among their usual surroundings. For the nests of these birds are either in evergreen, as holly or ivy, or surrounded by the delicate green tints of early spring vegetation, and may thus harmonise very well with the colours around them. The great majority of the eggs of our smaller birds are so spotted or streaked with brown or black on variously tinted grounds that, when lying in the shadow of the nest and surrounded by the many colours and tints of bark and moss, of purple buds and tender green or yellow foliage, with all the complex glittering lights and mottled shades produced among these by the spring sunshine and by sparkling raindrops, they must have quite a different aspect from that which they possess when we observe them torn from their natural surroundings."

Contrast the above passage with that already quoted. How definite the former and how vague, with its " mays " and its " mights ", how lame and halting is the latter.

Most of us have seen eggs amid their natural surroundings and I think we must admit that they are anything but coloured so as to appear inconspicuous.

Three very common Indian birds are able to disprove this theory, these are the king-crow, the tree-pie and the mynas. The first-named bird lays three distinct types of eggs, yet it builds but one type of nest. Some of the eggs are pure white, others have a white ground spotted with varying shades of red, while those of the third type are pinkish, spotted with purple, red and brown. Is it conceivable that all three types are protectively coloured ?

The Indian tree-pie (*Dendrocitta rufa*) has the peculiarity of laying eggs of almost any colours. Mr. W. Jesse thus writes of the eggs of this bird : " I have a most lovely series varying enormously in shape, size and colour. The commonest variety is leaden white profusely blotched with red ; but I have pure white examples with red, bluish green with reddish and yellowish brown, green with profuse yellow-brown blotches (like very spherical and miniature crow's), and pale yellowish green absolutely without a mark. With regard to these last, had I not—as, indeed, I have with every clutch of the tree-pie—observed the bird not once, but several times on the nest, and seen the eggs lifted out from under her, I would not have believed in their parentage."

In face of facts such as these I maintain that it is impossible to hold that the eggs of this bird are protectively coloured.

The eggs of all the mynas are blue, yet the nesting habits of the various species differ greatly. The common myna (*Acridotheres tristis*) nests in holes in the walls of buildings, *A. fuscus* builds in holes in wells or river cliffs, while the pied myna (*Stornopastor contra*) builds its nest in a tree. I maintain that it is almost inconceivable that the eggs of each of these species should need the same protective colour.

The mynas do not form an isolated instance. It may almost be stated as a general law that the eggs of nearly allied birds resemble one another even though the nesting habits of the species vary considerably. This alone is sufficient to disprove the protective theory.

Before leaving this hypothesis I may note one other fact for which it is unable to account. With birds that lay only two eggs it often happens that nearly all the colouring matter is imparted to one only, the other being left almost unpigmented.

The third theory need not detain us long. It has apparently been put forward only, because the first two theories are so unsatisfactory. The hypothesis that the colour of the eggs is determined by the influence of the surrounding tints on the retina of the female is said to account for the fact that eggs laid in dark places are white; the female while laying them sees no colours to impress her. The red splashes on the eggs of birds of prey are supposed to be due to the sight of blood. The fact that cuckoo's eggs often resemble in colour those of the host is likewise asserted to be due to the influence which the sight of the eggs already in the nest exerts upon the female. This appears to constitute the sum total of the evidence in favour of this theory. Not only is the evidence altogether inadequate and most unconvincing; but the theory is obviously incapable of explaining hundreds of phenomena of egg colouration—phenomena which it would be wearisome to detail. I submit that two of the above theories may be unhesitatingly rejected, while the remaining one is able only to explain the phenomena of the colouration of birds' eggs in certain cases. Whether it will ever be possible to explain all the various markings on birds' eggs, it is impossible to say. It seems to me that naturalists when they endeavour to trace in the colours of eggs in nests protective features, have altogether gone astray. It is with some diffidence that I venture to put forward what is in effect a new theory of the colouration of birds' eggs, for I am not a collector of eggs. Nevertheless the unsatisfactoriness of the theory which at present holds the field emboldens me to put forward my views upon this interesting subject.

I would divide eggs into three classes as regards their coloration,—those which are laid in dark places, those which are deposited in the open and not in a nest, and those which are laid in nests, yet exposed to daylight.

It seems to me that each of these three classes is exposed to an altogether different environment. The birds which build nests in deep holes or caverns must incubate them in almost total darkness. It must be a matter of considerable difficulty for such birds to distinguish their eggs; the only possible way for these to be visible is for them to be coloured white. It is, I think, of considerable importance that nesting birds should be able to see their eggs, for they have not the brain power to count them, so that if their eggs were quite invisible, some of them would by accident often get separated from the rest and thus fail to be hatched. Therefore natural selection will tend to cause the eggs which are laid in really dark places to become white. As evidence that it is important that the eggs under such circumstances should be white I may mention the puffin, which apparantly used, like its relatives, the auks, guillemots and razor-bills, to nest in the open. It now nests in burrows and covers the pattern on its eggs with a wash of white, through which the markings on the egg are often visible. This seems to me to furnish conclusive proof that the whiteness of eggs laid in dark places is not due merely to the cessation of the action of natural selection as some naturalists assert. I hold that eggs in burrows, &c., are subject to natural selection which tends to cause them to become white, but that natural selection acts thus only in cases where the nest is so dark that coloured eggs would be practically invisible.

With regard to the second class of eggs—those laid in the open and not in nests but altogether exposed—it is obviously of the greatest importance that such eggs should be protectively coloured, that they should resemble as much as possible their surroundings. That such eggs almost invariably fulfil this condition is, I think, well established. The result is of course due to the action of natural selection. The eggs lie exposed, and those which least resemble their surroundings will be the ones most likely to be devoured by animals.

There remains the third class of eggs. This comprises those laid in nests, but not in the dark. There is no use in such eggs being white; for, no matter what their colour be, the bird to which the nest belongs will have no difficulty in seeing them. It is also, I submit, quite unnecessary for them, hidden away as they are in the nest, to be of the same colour as either the lining of the nest or the surrounding foliage. It is of importance to the species that the *nest* should be well concealed, or domed, or otherwise rendered difficult of access. It is upon this that the safety of eggs depends and not on their colour. When once a nest containing eggs is discovered by a crow, a tree-pie or a lizard, all hope for the eggs is gone. The bird or reptile having made such a find will not leave it until it has made sure it contains no eggs. In order that the eggs in a nest should escape the notice of such vigilant creatures it would be necessary for them to be so coloured as to be indistinguishable except upon the most careful scrutiny from the lining of the nest, or for the owner of the nest, on leaving it, to invariably cover them up by making a false bottom to the nest. This latter precaution would be a far greater protection than any colouring.

The idea of a lizard which has climbed up into a bulbul's nest in a croton plant being deceived by the markings on the eggs into thinking that the nest is empty is ludicrous. Yet the theory of protective colouration demands that the eggs shall be coloured so as to be distinguishable only with the utmost difficulty from their surroundings.

It would therefore seem that such eggs are neither protectively coloured nor subject to the action of natural selection. I believe that they are in a state of *panmixia*, that to them one colour is as useful as another, that among them variation and heredity are allowed free play. We know how in animals under domestication all manner of colours arise apparently without any selection. I believe that eggs laid in nests are in a similar condition, that variations in colour or markings are neither harmful nor beneficial. If this be so, it is obviously futile to endeavour to discover protective resemblances in the markings of eggs; we should rather regard birds' eggs as perhaps the most convenient and interesting material at our disposal for the study of variation.

I do not think that because birds' eggs are in a state of *panmixia*, they are more variable than they would be if subject to the action of natural selection.

I simply believe that eggs show greater variation than the birds themselves, because in the case of the former there is no force operating to cut off considerable variations in all directions save one. If we take any hundred adult animals and study the variations they exhibit, we are dealing with, so to speak, a hundred picked animals, a hundred specially selected creatures, a hundred organisms which have survived the weeding process of natural selection. Since all animals are admirably adapted to their environment, natural selection, so long as that environment remains constant, merely acts as a restraining force by cutting off all abnormal forms,—that is to say, all members of the species which vary greatly from a given mean. It is only under a changing environment that natural selection causes evolution or the origin of new species. Our hundred animals, then, will be a hundred which have survived because they exhibit only a small degree of variation. For this reason, it is probable that naturalists are inclined to underestimate the amount of variation of which organisms are capable. If this view be correct and if eggs be, as I think, in a state of *panmixia*, then they should exhibit greater degrees of variation than the birds themselves do. This I believe is actually the case. I unfortunately know too little of birds' eggs to be able to speak with assurance, but I think that scientific egg-collectors will bear me out that birds' eggs do exhibit very large variations. It would also appear to be established that some eggs vary more than others. This also applies to animals and plants. It would be interesting to learn whether those species of birds which are most variable lay the most variable eggs. I would therefore regard a collection of birds' eggs as most valuable material for the study of variation and not as so many examples of protective colouration. Of course this theory makes no attempt to account for the origin of variations in birds' eggs; it does not explain why some should be uniformly coloured while others should exhibit pencillings and markings. But the theory of sexual selection fails to explain the beautiful markings on the feathers of a peacock, and the theory of *panmixia* does not account for the origin of the various colours which are exhibited by animals under domestication. I do, however, think it possible that if birds' eggs be studied carefully, they may throw some fresh light on the unknown causes of variation.

In conclusion, I would briefly point out a few facts which to my way of thinking are inexplicable on the theory that eggs in nests are protectively coloured, but which follow from, or at any rate present no difficulty on, the assumption that such eggs are in a state of *panmixia* :—

1. Allied species of birds, even though their nesting habits are very different, as a rule lay similarly coloured eggs.

2. Eggs laid in domed nests certainly do not need protective colouring, yet many of these are coloured.

3. The same is true of many eggs laid in holes, in trees or in buildings.

4. The protective resemblances of eggs which are laid in the open are apparent to every one, which certainly is not true of those deposited in nests.

5. Many birds lay eggs which exhibit very great variations.

6. Some birds lay eggs of different types, and these sometimes differ from one another so greatly, that it is difficult to believe that they could have been laid by the same species.

THE BIRDS OF TRAVANCORE.

By H. S. Fergusson, F.L.S.,

WITH NOTES ON THEIR NIDIFICATION

By T. F. Bourdillon, F.L.S.

(*With a Plate.*)

Part II.

(*Continued from page* 264 *of this Volume.*)

Family SITTIDÆ.

(36) Sitta frontalis.—The Velvet-fronted Nuthatch.

Oates, No. 325 ; *Jerdon, No.* 253.

This Nuthatch is common on the hills above 2,000 feet. It may be found in more or less open places in the forest or on the margins of clearings or grass land.

Family DICRURIDÆ.

(37) Dicrurus ater.—The Black Drongo.

Oates, No. 327 ; *Jerdon, No.* 278.

The King Crow is common in the plains and at low elevations on the hills. "Eggs," says Mr. T. F. Bourdillon, "may be obtained in any quantities in the low country in June and July."

(38) Dicrurus longicaudatus.—The Indian Ashy Drongo.

Oates, No. 328 ; *Jerdon, No.* 280.

Common in the low country and on the hills at all elevations.

(39) Chaptia ænea.—The Bronzed Drongo.

Oates, No. 334 ; *Jerdon, No.* 282.

Common like the last.

(40) Dissemurus paradiseus.—The Larger Racket-tailed Drongo.

This fine drongo is common from the foot of the hills to about 3,000 feet. It is a cheerful bird with a grand variety of notes and is a good mimic. Mr. F. W. Bourdillon says :—"I have often been amused to hear it imitate the cry of the Harrier eagle and see it make a sudden charge down on some smaller bird, either in sheer mischief or to secure some insect which the latter has captured. I have also heard one imitate exactly the evening note of the ground thrush (*Pitta brachyura*)." It breeds in April and May.

Family SYLVIIDÆ.

(41) LOCUSTELLA STRAMINEA.—The Turkestan Grasshopper Warbler.

Oates, No. 362 ; *Jerdon, No.* 520.

This warbler is said to be a winter visitor to the plains of India. I have only one specimen, and that was shot in a swamp at 4,000 ft. elevation in April, 1901. There were more of them, but they were very difficult to get, as once flushed they would not rise again, so that they have to be shot on the wing directly they rise, and there is not much to shoot at.

(42) ACROCEPHALUS STENTORIUS.—The Indian Great Reed-warbler.

Oates, No. 363 ; *Jerdon, No.* 515.

Only one specimen obtained.

(43) ACROCEPHALUS DUMETORUM.—Blyth's Reed-warbler.

Oates, No. 366 ; *Jerdon, No.* 516.

A common bird in the hills and plains from November to April, but not easy to find, as it frequents the densest undergrowth and keeps as much out of sight as possible. It will come quite close and keeps up a continuous sharp "chick-chick," but rarely shows. They do not confine themselves to well-watered localities, but frequent brushwood anywhere.

(44) ORTHOTOMUS SUTORIUS.—The Indian Tailor-bird.

Oates, No. 374 ; *Jerdon, No.* 530.

A common bird in the plains frequenting gardens, also at the foot of the hills. Its loud note "pretty-pretty" is one of the most familiar sounds and would lead one to expect a much larger bird. Breeds in May.

(45) CISTICOLA ERYTHROCEPHALA.—The Red-headed Fantail Warbler.

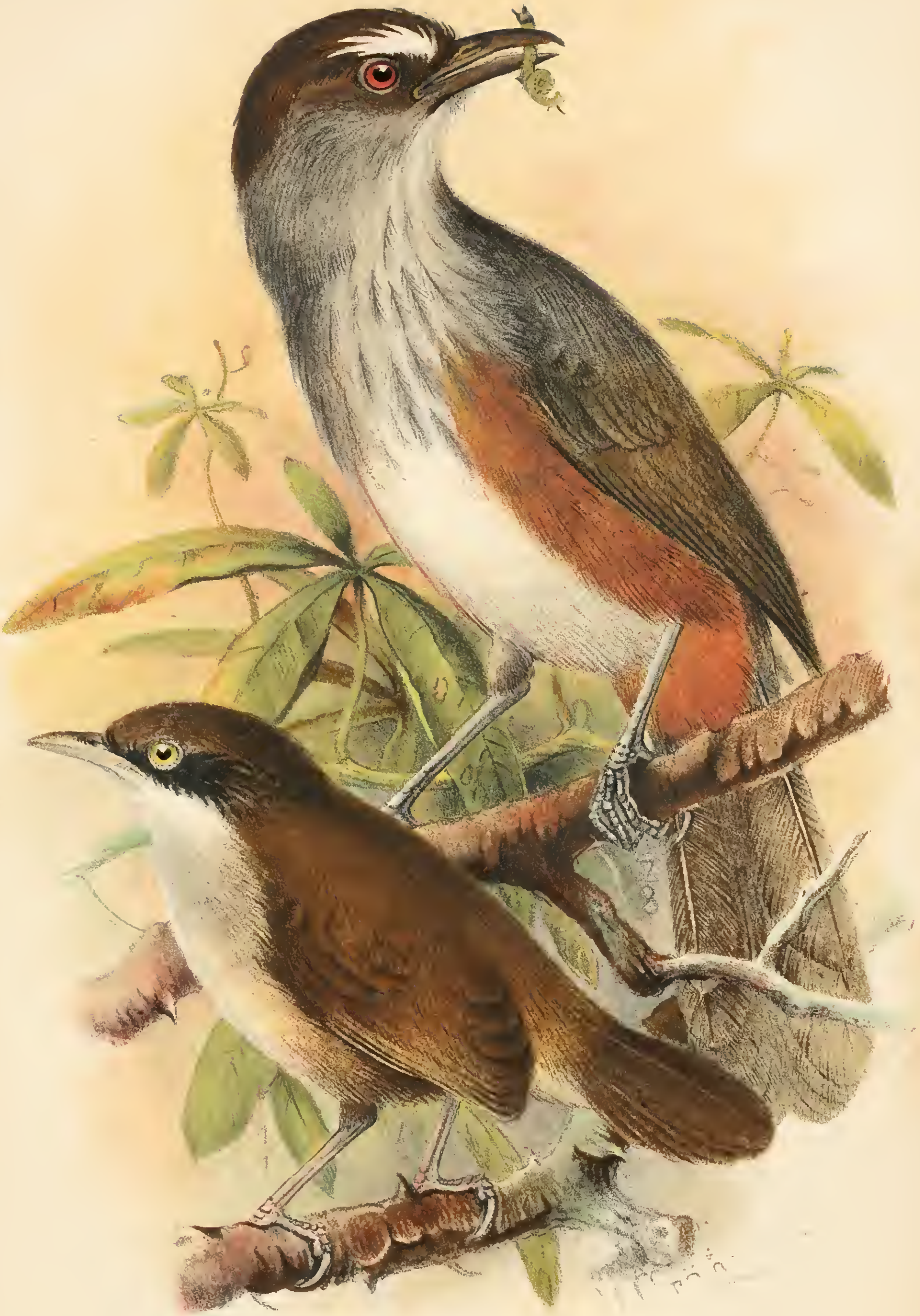
Oates, No. 378 ; *Jerdon, No.* 540.

I have only found this bird on the High Range on grass lands where it is fairly common and a permanent resident.

(46) CISTICOLA CURSITANS.—The Rufous Fantail Warbler.

Oates, No. 381 ; *Jerdon, No.* 539.

I first found this bird in paddy fields about Cape Comorin where there were numbers, but I subsequently found it about Trivandrum also.



H. Grönvold del et lith

Mintern Bros Chromo London.

1. BLANFORD'S LAUGHING THRUSH.
Trochalopterum meridionale.
2. BOURDILLON'S BABBLER.
Rhopocichla bourdilloni.

(47) Franklinia gracilis.—Franklin's Wren-warbler.

Oates, No. 382 ; *Jerdon, No.* 538.

Common in the plains and throughout the hill range at all elevations, sometimes goes about in flocks, sometimes singly, frequenting grass-land and open tree jungle. In one locality I found numbers of them in the reeds all round the shores of a fresh water lake.

Mr. T. F. Bourdillon writes :—" The nest of this bird is a neat structure of fine grass resting on a leaf as a foundation which is stitched to the nest after the fashion of Tailor-bird's nests. The number of eggs, is 3—4, and their colour is a delicate blue, sometimes plain and sometimes spotted with brick red which often runs into a zone at the larger end. The bird builds in May, June and July, and the nest is placed at a height of 3—4 feet from the ground in a bush. It does not ascend the hills to breed, but prefers elevations about 300 to 800 or 1,000 feet above sea-level."

(48) Schœnicola platyura.—The Broad-tailed Grass-warbler.

Oates, No. 390 ; *Jerdon, No.* 442.

This grass-warbler is to be found in grass-lands on the summits of the hills in South Travancore. I have not met with it either at Pirmerd nor on the High Range. It is not a shy bird, but may often be seen perched on the top of a bush or tuft of grass. It has a habit of soaring a few feet up into the air, while it gives vent to a feeble little song. If it is disturbed or flushed, it at once seeks shelter in the grass and will rarely rise a second time. I have not taken the nest.

(49) Arundinax ædon.—The Thick-billed Warbler.

Oates, No. 393 ; *Jerdon, No.* 518.

This is a very occasional winter visitor. I have only one specimen shot at the foot of the hills.

(50) Hypolais rama.—Sykes' Tree Warbler.

Oates, No. 394 ; *Jerdon, No.* 553.

This bird is also only a winter visitor, and I have only obtained one specimen at Cape Comorin in December, 1901 ; I have not met with it in North Travancore though it is found in the Nilgiris.

(51) Phylloscopus affinis.—Tickell's Willow-warbler.

Oates, No. 405 ; *Jerdon, No.* 561.

Oates describes this bird as " a winter visitor to the plains of India extending down to the Palni Hills." I have taken it only in the High Range at 6,000 feet during the winter months and never in the plains.

(52) Acanthopneuste nitidus.—The Green Willow-warbler.

Oates, No. 421 ; *Jerdon, No.* 559.

The Green Willow-warbler is a winter visitor to the plains and hills throughout Travancore. It is usually found in heavy jungle in the hills frequenting high trees, but sometimes descending to the underwood. It is possible that some birds remain through the summer, as I have two specimens shot at an elevation of 4,000 feet in July.

(53) Acanthopneuste viridanus.—The Greenish Willow-warbler.

Oates, No. 422 ; *Jerdon, No.* 560.

This is a fairly common winter visitor to the hills throughout Travancore, most commonly at elevations of 2,000 to 3,000 feet, but I have also seen it on the High Range, and it may sometimes be met with in the low country.

(54) Acanthopneuste magnirostris.—The Large-billed Willow-warbler.

Oates, No. 424 ; *Jerdon, No.* 556.

Another winter visitor less abundant than *A. nitidus* according to Mr. F. W. Bourdillon. My experience is that it is rare, as I have only seen two specimens at the summit of the hills in South Travancore.

(55) Acanthopneuste occipitalis.—The Large-crowned Willow-warbler.

Oates, No. 428 ; *Jerdon, No.* 563.

This bird is said by Oates to be found throughout the peninsula of India from the foot of the Himalayas to about the latitude of Belgaum and Nellore. It is, however, not uncommon in the winter months at high elevations in the Travancore hills, where it frequents trees going about in small flocks.

(56) Prinia socialis.—The Ashy Wren-warbler.

Oates, No. 464 ; *Jerdon, No.* 534.

The Ashy Wren-warbler is common in the grass lands of Pirmerd and the High Range and may also be found in the low country in suitable localities. Mr. T. F. Bourdillon writes :—" Breeds most abundantly on the lower slopes of the hills in May and June and also in July. I have had great numbers of the eggs brought me by the hillmen. The nest is composed of very fine grass roots, and is sometimes of large size, while at other times it is more than 2 to 3 inches in diameter and has a leaf woven in as a foundation.

They are generally placed low in a bush and contain from 3—4 glossy bright brick-red eggs, with a zone of darker colour round the top."

The average size is ·58 × ·49.

(57) Prinia inornata.—The Indian Wren-warbler.

Oates, No. 466; *Jerdon, No.* 543.

The Indian Wren-warbler is common in the grass lands at Pirmerd and the High Range, so that the range as given by Oates, *viz.*, "the whole of India from the Himalayas to the Nilgiri Hills," may be extended so far further south. It is often to be found in company with the next species.

(58) Prinia jerdoni.—The Southern Wren-warbler.

Oates, No. 467; *Jerdon, No.* 544.

This Wren-warbler is found on the plains and on the hills at all elevations up to 6,000 feet.

Family LANIIDÆ.

(59) Lanius vittatus.—The Bay-backed Shrike.

Oates, No. 473; *Jerdon, No.* 260.

This is one of the birds which are to be found only about Cape Comorin and not elsewhere in Travancore. I obtained two specimens there in December, 1901.

(60) Lanius erythronotus.—The Rufous-backed Shrike.

Oates, No. 476; *Jerdon, No.* 257.

This shrike is not uncommon in the plains and also ascends the hills. I have specimens shot in the High Range in February and March, and a pair regularly frequented the garden of the Hill Magistrate at Devicolum on the High Range.

(61) Lanius cristatus.—The Brown Shrike.

Oates, No. 481; *Jerdon, No.* 261.

The Brown Shrike is a winter visitor to the hills where it is found from about 2,000 feet upwards. One specimen I had brought to me from the low country in North Travancore in December, 1902, all the others from elevations of over 2,000 feet, and I have shot it on the High Range at 6,000 feet.

(62) Hemipus picatus.—The Black-backed Pied Shrike.

Oates, No. 484; *Jerdon, No.* 267.

Mr. F. W. Bourdillon says of this:—"Not very abundant; frequents the tops of trees at the higher elevations." I have seen and shot specimens at all elevations from the foot of the hills to the summits throughout the range. They usually go about in small parties.

(63) TEPHRODORNIS SYLVICOLA.—The Malabar Wood-shrike.
Oates, No. 487; *Jerdon, No.* 264.

This bird is common from the foot of the hills to about 3,000 feet in heavy forest. They go about in small flocks, and on one occasion when I shot and wounded one the remainder of the party regularly mobbed me when I picked it up, flying round and round and almost; into my face, uttering harsh chattering notes.

(64) TEPHRODORNIS PONDICERIANUS.—The Common Wood-shrike.
Oates, No. 488; *Jerdon, No.* 265.

Common in the low country in thin open jungle and about gardens. The male has a tuneful whistle.

(65) PERICROCOTUS FLAMMEUS.—The Orange Minivet.
Oates, No. 494; *Jerdon, No.* 272.

Mr. F. W. Bourdillon describes this as "a common species of gregarious habits, generally (as Jerdon says) frequenting the tops of tall trees. The males have a rather pleasing but feeble warbling song, which they utter on the wing, while taking a short flight from the top of a tree and usually returning to the same perch." I have shot them at all elevations on the hills up to 4,000 feet throughout the Range.

(66) PERICROCOTUS ROSEUS.—The Rosy Minivet.
Oates, No. 499; *Jerdon, No.* 275.

Jerdon says of this bird :—"Lord A. Hay informed that he had seen it most abundant on the hills dividing Tinnivelly from Travancore and collections from this latter country always include it." The bird is by no means so common as this would lead one to suppose. I have never come across it myself, but my collector obtained two specimens at an elevation of 2,500 feet in South Travancore.

(67) PERICROCOTUS PEREGRINUS.—The Small Minivet.
Oates, No. 500; *Jerdon, No.* 276.

The Small Minivet is fairly common in the low country, but does not ascend the hills.

(68) CAMPOPHAGA SYKESI.—The Black-headed Cuckoo-shrike.
Oates, No. 508; *Jerdon, No.* 268.

This shrike is a resident and is found most commonly in the low country. I have also taken it on the hills at about 2,500 feet elevation.

(69) Graucalus macii.—The Large Cuckoo-shrike.

Oates, No. 510 ; *Jerdon, No.* 270.

Not uncommon in the low country in thin jungle ; ascends the hills to about 1,500 feet. Travancore birds vary from 10 to 11 inches in length, wing 6 inches, tail 4 5/8 to 5 inches.

(70) Artamus fuscus.—The Ashy Swallow-shrike.

Oates, No. 512 ; *Jerdon, No.* 287.

Common in the low country throughout Travancore, more especially in the extreme south, where the palmyra palms predominate. It ascends the hills in the dry weather.

Family ORIOLIDÆ.

(71) Oriolus indicus.—The Black-naped Oriole.

Oates, No. 514 ; *Jerdon, No.* 471.

An occasional winter visitor to the low country. I have only one specimen obtained in Trivandrum.

(72) Oriolus kundoo.—The Indian Oriole.

Oates, No. 518 ; *Jerdon, No.* 470.

This oriole is by no means common, but may be sparingly met with both in the plains and in the hills up to 3,000 feet elevation. It is a resident.

(73) Oriolus melanocephalus.—The Indian Black-headed Oriole.

Oates, No. 521 ; *Jerdon, Nos.* 472-473.

The Black-headed Oriole is by far the commonest of the three orioles that are found in Travancore. It is a permanent resident in the low country and does not ascend the hills.

Family EULABETIDÆ.

(74) Eulabes religiosa.—The Southern Grackle.

Oates, No. 523 ; *Jerdon, No.* 692.

This is one of the commonest and noisiest birds and is found in the hills up to 3,000 feet elevation in the south and up to 5,000 feet on the High Range in the north. Towards evening especially it makes itself heard.

" Breeds most abundantly at elevations of 1,500 to 3,000 feet, generally choosing for the site of its nest a hole in a dead tree on the outskirts of the forest or in the middle of a clearing. The tree selected is generally of a large size, and the nest is placed at 25 to 50 feet from the ground; hence, though it is easy enough to find the nest, it is very difficult to take the eggs of this bird without calling in the aid of the hillmen. They manage to ascend the largest tree by tying bamboos as ladders, which are held in their places by straps carried round the tree, each bamboo being thus attached in three or four places besides being tied to the bamboo below it and above it. The nest is very slight, being a few feathers and straws laid at the bottom of a hole. The usual number of eggs is two, but sometimes the bird sits on a solitary egg, and in these cases the egg is usually larger and lighter in colour. The shell is fine and smooth with a slight gloss. The colour of the eggs is light-blue, sparingly spotted with purple, chocolate and claret."—*T. F. B.*

The average size is 1·35 × 0·9.

FAMILY STURNIDÆ.

(75) PASTOR ROSEUS.—The Rose-coloured Starling.

Oates, No. 528; *Jerdon, No.* 690.

Found in large flocks both in the low country and on the hills from September to April usually. I have seen them as late as May occasionally.

(76) STURNIA BLYTHII.—Blyth's Myna.

Oates, No. 537; *Jerdon, No.* 689.

I have not myself come across this bird. Mr. F. W. Bourdillon obtained it in the hills in March, and my collector got two specimens in April at the foot of the hills.

(77) STURNIA MALABARICA.—The Grey-headed Myna.

Oates, No. 538; *Jerdon, No.* 688.

The Grey-headed Myna is common at the foot of the hills, where flocks of them may be met with. They occasionally ascend the hills, but not higher than 2,000 feet.

(78) TEMENUCHUS PAGODARUM.—The Black-headed Myna.

Oates, No. 544; *Jerdon, No.* 687.

I have only obtained this bird in the dry country in the extreme south about Nagercoil and Cape Comorin where it is not uncommon.

(79) ACRIDOTHERES TRISTIS.—The Common Myna.

Oates, No. 549; *Jerdon, No.* 684.

Very common in the low country everywhere; breeds in April.

(80) ÆTHIOPSAR FUSCUS.—The Jungle Myna.

Oates, No. 552; *Jerdon, No.* 686.

Common in well-wooded parts of the low country up to the foot of the hills, which it does not ascend. Travancore birds vary somewhat in size in the length of the wing from 4·6 to 5·1.

FAMILY MUSCICAPIDÆ.

(81) CYORNIS PALLIDIPES.—The White-bellied Blue Flycatcher.

Oates, No. 573; *Jerdon, No.* 309.

I have not come across this flycatcher at all, nor does Mr. F. W. Bourdillon mention it in his "First List." He must, however, have obtained specimens subsequently, as Dr. Bowdler Sharpe has kindly informed me that the British Museum possesses "a male collected by Bourdillon in Travancore, 24 ii. 78," and another male "Mynall, no date," Mynall being the name of Mr. Bourdillon's coffee estate—now, alas! like so many others in Travancore, abandoned and grown up in jungle. According to the "Second List" it is not rare, although nowhere common, in all heavy jungle from 1,000 feet and upwards.

(82) STOPAROLA MELANOPS.—The Verditer Flycatcher.

Oates, No. 579; *Jerdon, No.* 301.

Mr. F. W. Bourdillon writes of this bird as follows:—"Common though not abundant up to 2,000 feet elevation, and prefers clearings in the forest wherever there are heaps of unburnt brushwood lying about. Is a winter visitor from December to March." I have not met with it, and as Oates expressly states that it is absent from "that portion of the Peninsula of India south of the Nilgiris," I wrote for information, and Dr. Bowdler Sharpe informs me that there are "two specimens of *Stoparola melanops*, ♂ ♀, collected by Bourdillon in Mynall, 27th November, 1874, another male same place, 2nd December, 1878."

(83) STOPAROLA ALBICAUDATA.—The Nilgiri Blue Flycatcher.

Oates, No. 581; *Jerdon, No.* 302.

Mr. Bourdillon records this as follows:—'Is more frequently observed in forest with thick underwood, and prefers a rather higher elevation than the last species (*S. melanops*)," but sent no specimens to Mr. Hume. Oates, therefore, gives its distribution as the Nilgiri and Palni Hills. It is, however, common from the High Range to the extreme south. It is found at the summits of the hills in forest and is abundant. It has a very sweet song.

I may here rectify a mistake I made in writing in this journal, Vol. xii, page 202, that *Stoparola sordida* is found in Travancore. It does not occur.

(84) ALSEONAX LATIROSTRIS—The Brown Flycatcher.

Oates, No. 588; *Jerdon, No.* 297.

Common in winter from the foot of the hills to about 3,000 feet, found occasionally also in the low country. Some birds, however, are resident, as I have specimens collected in June and in August. Oates in his key to the genera of the *Muscicapidæ* puts *Alseonax* in the division having the "second primary very much shorter than the fifth." This does not hold good, as all my Travancore specimens have the second primary quite equal to and sometimes longer than the fifth.

(85) ALSEONAX RUFICAUDUS.—The Rufous-tailed Flycatcher.

Oates, No. 589 ; *Jerdon, No.* 307.

Mr. F. W. Bourdillon records this without any notes as to its habits. I have not met with it and therefore conclude that it is a rare winter visitor.

(86) ALSEONAX MUTTUI.—Layard's Flycatcher.

Oates, No. 590 ; *Hume, No.* 307 *bis.*

Under the name *Cyornis mandelli* Hume mentions two specimens sent to him by Mr. F. W. Bourdillon. I have since secured another. It is a rare winter visitor.

(87) OCHROMELA NIGRIRUFA.—The Black-and-orange Flycatcher.

Oates, No. 591 ; *Jerdon, No.* 300.

This flycatcher is common on the High Range and at elevations of 3,500 to 4,000 feet in the south. It frequents thick jungle, and though of silent habit is by no means shy.

Mr. T. F. Bourdillon writes:—"The nest, unlike that of most flycatchers, is domed, and is composed of the leaves of the Irul reed, lined inside with fine lichen and small roots; it is usually placed on a small bush from four to six or eight feet from the ground. The number of eggs is two or three, of a brownish-yellow colour, thickly mottled and blotched with red and darker shades of the ground colour, generally forming a zone at the larger end. I have taken fresh eggs in April, which month and May are its breeding season.

The average of several eggs is ·65 × ·50."

(88) Culicicapa ceylonensis.—The Grey-headed Flycatcher.

Oates, No. 592 ; *Jerdon, No.* 295.

This bird is common on the High Range and on the tops of the hills in the south. It is not a shy bird and will sit on a bough within a few feet of you and make its little flights, returning fearlessly to its former position. It has a rather loud note.

(89) Terpsiphone paradisi.—The Indian Paradise Flycatcher.

Oates, No. 598 ; *Jerdon, No.* 288.

Very common in low country jungles and also ascends the hills in the dry weather to considerable elevations. I have shot it on the High Range at 6,000 feet and on the summits of the hills in the south.

(90) Hypothemis azurea.—The Indian Black-naped Flycatcher.

Oates, No. 601 ; *Jerdon, No.* 290.

Fairly common on the hills, frequenting the tops of trees, sometimes in small parties, sometimes singly. Some specimens have no crescentic black bar across the foreneck.

(91) Rhipidura albifrontata.—The White-browed Fantail Flycatcher.

Oates, No. 604 ; *Jerdon, No.* 292.

Common in the low country. It has a curious song consisting of seven notes, reminding one of the first bars of the "Guards" valse. Breeds in April.

Family TURDIDÆ.

Sub-family *Saxicolinæ.*

(92) Pratincola atrata.—The Southern Pied Bush-chat.

Oates, No. 609 ; *Jerdon, No.* 482.

Abundant in the grass lands at Pirmerd and the High Range, going about in pairs. They take their station on a bush and capture their insect prey on the ground, returning to their perch.

Oates gives the distribution as "Southern India from the Nilgiris to Cape Comorin above 5,000 feet." At Pirmerd they are found at 3,000 feet, and they are not found south of it.

(93) Thamnobia fulicata.—The Black-backed Indian Robin.

Oates, No. 662 ; *Jerdon, No.* 479.

This is not a common bird, but may be found in the low country. I have also seen it on the hills at 2,000 feet elevation in the dry season.

(94) COPSYCHUS SAULARIS.—The Magpie Robin.

Oates, *No.* 663; *Jerdon*, *No.* 475.

This is essentially a bird of the plains and frequents human habitations. It has a fine song which may be heard as soon as the light begins as the sun rises.

It breeds in February and March.

(95) CITTOCINCLA MACRURA.—The Shama.

Oates, *No.* 664; *Jerdon*, *No.* 476.

The shama is not common in Travancore, it frequents jungle and is decidedly shy. It does not ascend the hills.

Sub-family *Turdinæ.*

(96) MERULA BOURDILLONI.—Bourdillon's Black Bird.

Oates, *No.* 669.

This Black Bird is fairly common on the High Range and above 3,500 feet in the south. It may be found feeding on the jungle roads in the twilight both morning and evening. As soon as the sun rises it retires into the jungle. It is a shy and silent bird. Mr. Harley informs me that he found a nest of this bird on the top of an old stump in a tea clearing on the High Range. Mr. Bourdillon and I took a nest at Chimunji in April, 1903, of which he gives the following description:—" The nest was placed on an overhanging branch about 12 feet from the ground. It was composed almost entirely of fresh moss with a few roots and small sticks interwoven in the structure. The outside measurement was 8 inches long, 6 inches broad and 8 inches deep. The cavity of the nest was 3 inches deep and 4 inches across, the interior being lined with fine grass and roots neatly finished off. The nest contained two fresh eggs measuring 1·18 × ·90 inches and 1·12 × ·85 inches. The ground colour of the eggs was pale-green, spotted and blotched with reddish-brown of two shades, the markings having a tendency to collect at the larger end. One egg is much brighter and its markings are much darker than the other."

(97) GEOCICHLA WARDI.—The Pied Ground-thrush.

Oates, *No.* 685; *Jerdon*, *No.* 357.

This is a rare bird, of which I have only one specimen shot in February on the High Range.

(98) GEOCICHLA CYANONOTUS.—The White-throated Ground-thrush.

Oates, No. 685; *Jerdon, No.* 354.

This thrush frequents heavy forest from about 2,000 feet and may be met with on the roads at dusk. Oates says "it appears to be resident or very locally migratory." Mr. F. W. Bourdillon records it as "a winter visitor." My experience bears this out, as I have not seen it earlier than November nor later than the end of March.

(99) PETROPHILA CINCLORHYNCHA.—The Blue-headed Rock-thrush.

Oates, No. 691; *Jerdon, No.* 353.

Is a winter visitor throughout the Range from 500 to 2,500 feet in the south and also at 5,000 feet on the High Range. It frequents forest in the neighbourhood of cultivation.

(100) PETROPHILA CYANUS.—The Western Blue Rock-thrush.

Oates, No. 693; *Jerdon, No.* 355.

This also is only a winter visitor from October to April. It is a solitary bird, found always in the open and never in jungle. It frequents grass land where there are rocks.

(101) OREOCINCLA NILGIRIENSIS.—The Nilgiri Thrush.

Oates, No. 699; *Jerdon, No.* 372.

This is a rare bird. I have specimens from the High Range, and it is also found sparingly in the south. I have not taken it below 4,000 feet elevation, but Mr. F. W. Bourdillon records it as found in thick jungle from the summit of the hills down to 2,000 feet elevation.

FAMILY PLOCEIDÆ.

Sub-family *Ploceinæ.*

(102) PLOCEUS BAYA.—The Baya.

Oates, No. 720; *Jerdon, No.* 694.

The weaver bird is common in the low country, but does not ascend the hills. "The nest of the weaver bird is usually attached to the areca nut palm at a height of 30—40 feet from the ground. It is beautifully composed of grass and is often a foot and a half in length. The cavity for the eggs is completely domed and covered in on all sides, with the exception of a passage from 4 to 6 inches in length, which runs in a slanting upwards direction and admits the bird. Many of the nests are not used for egg receptacles, and they are nearly all weighted with lumps of clay interiorly, probably to prevent the wind having such power over them. The nests are usually placed in clusters, ten or twenty being sometimes seen on one tree. The eggs are dead white, rather pointed. The breeding season is May—August. The average is ·8 × ·6."—*T. F. B.*

(103) PLOCEUS MANYAR.—The Striated Weaver-bird.

Oates, No. 723 ; *Jerdon, No.* 695.

This bird like the last is confined to the plains where it is not uncommon. Mr. T. F. Bourdillon writes :—" I found the Striated Weaver-bird building in the Vellanie Lake (six miles from Trivandrum) in June. It builds a hanging nest from the reeds which grow in the water. I was, however, too early for the eggs, and though I sent another year purposely to obtain the eggs of this bird, of *Ardea purpurea*, and of *Porphyrio poliocephalus*, which were all building there in 1876, for some reason the reeds had all disappeared and there were no nests. The nest is considerably smaller than that of *Ploceus baya* and made of coarser materials. The eggs are 2—3 in number.

Sub-family *Viduinæ*.

(104) MUNIA MALACCA.—The Black-headed Munia.

Oates, No. 725 ; *Jerdon, No.* 697

The Black-headed Munia is only found in the low country, where flocks of them may often be met with, especially about the backwaters. Breeds from May to August.

(105) UROLONCHA STRIATA.—The White-backed Munia.

Oates, No. 728 ; *Jerdon, No.* 701.

This munia occurs more commonly than the former and sometimes ascends the hills in the south to 2,500 feet, where it prefers secondary jungle. It is found at the foot of the hills also, and generally frequents the interior rather than the backwaters near the coast. Breeds from May to August.

(106) UROLONCHA PECTORALIS.—The Rufous-bellied Munia.

Oates, No. 732 ; *Jerdon No.* 700.

This is decidedly *the* hill munia. It is common throughout the Range. Mr. T. F. Bourdillon describes the nest as "a rough domed one of fine grass with a few feathers inside, in which the bird lays six to eight pure white eggs without gloss. The nest is usually placed in a hole in a tree and is sometimes built among long grass at a height of 3 or 4 feet from the ground. The nesting season extends from June to

August, and the bird builds at elevations of 2,000 feet and upwards above sea-level.

Average size of eggs ·60 × ·42."

(107) Uroloncha malabarica.—The White-throated Munia.
Oates, No. 734 ; *Jerdon, No.* 703.

Oates' description of the distribution of this bird, *viz.*, "The whole continent of India from the Himalayas to Cape Comorin and Ceylon," leaves out the essential characteristic which is that it is only found where there is a dry climate. Its specific name is ill bestowed, as it is far from common in Malabar and other well-wooded districts. In Travancore it is only found in the dry open country about Cape Comorin where it is fairly common, going about in flocks. Breeds from December to March.

(108) Uroloncha punctulata.—The Spotted Munia.
Oates, No. 735 ; *Jerdon, No.* 699.

The Spotted Munia is fairly common in the low country, but does not ascend the hills. It frequents gardens, compounds and paddy fields. Breeds April to July. Oates says that *Sporæginthus amandava* is found throughout the whole of India proper from the foot of the Himalayas to Cape Comorin. This is incorrect. It may occur pretty far south on the eastern side, but it is not found at Cape Comorin nor anywhere else in Travancore.

Family FRINGILLIDÆ.

(109) Carpodacus erythrinus.—The Common Rose-finch.
Oates, No. 761 ; *Jerdon, No.* 738.

Oates says this bird is "a winter visitor to the whole of India as far south as the Nilgiris," for Nilgiris may be substituted the High Range in Travancore where it is fairly common from December to March, frequenting both open country in flocks and also sholas.

(110) Gymnorhis flavicollis.—The Yellow-throated Sparrow.
Oates, No. 775 ; *Jerdon, No.* 711.

Fairly common in the low country. Breeds in May and June.

(111) Passer domesticus.—The House-sparrow.
Oates, No. 776 ; *Jerdon, No.* 706.

Common in the low country. It also ascends the hills at times where there is cultivation, following the rice carts. Breeds in February and March.

FAMILY HIRUNDINIDÆ.

(112) HIRUNDO RUSTICA.—The Swallow.

Oates, *No.* 813 ; *Jerdon*, *No.* 82.

(113) HIRUNDO GUTTURALIS.—The Eastern Swallow.

Oates No. 814.

Swallows of these two species are fairly common throughout the low country during the winter months, but it is very difficult to discriminate them. A few of my specimens may be certainly put down as typical *H. rustica* having the chin and throat chestnut, a broad, uninterrupted, black, pectoral band and the lower plumage from the pectoral band very pale-rufous. Others again have the chin and throat greyish-white. Others have the pectoral band much interrupted, not in the middle only, but throughout by chestnut. Some of these have the lower parts white, others pale-rufous, so that they are absolutely intermediate between the types. I sent a few to Calcutta, and Mr. Finn identified them as *H. gutturalis*, but added they are not typical.

(114) HIRUNDO JAVANICA.—The Nilgiri House-swallow.

Oates, *No.* 817 ; *Jerdon*, *No.* 83.

The Nilgiri House-Swallow may be found at elevations of 4,000 feet and upwards throughout the Hill Range of Travancore. "Breeds in March, April and May, building a nest of mud very carefully lined with feathers. The usual site for the nest is under the eaves of a house, but I have seen the nest placed against a rock. Unlike its European congener these birds do not build in colonies, and I cannot remember ever having seen more than one nest in any place. The eggs are one or three in number, white, spotted with red, and are conspicuously smaller than those of the common English swallow."—*T. F. B.*

(115) HIRUNDO ERYTHROPYGIA.—Syke's Striated Swallow.

Oates, *No.* 823 ; *Jerdon*, *No.* 85.

Oates gives the distribution of this swallow as "the plains of India from the foot of the Himalayas to the Nilgiris." It, however, extends to the low country throughout Travancore, and I shot one specimen on the High Range at an elevation somewhat over 5,000 feet.

FAMILY MOTACILLIDÆ.

(116) MOTACILLA ALBA.—The White Wagtail.

Oates, *No.* 826.

Oates says this bird is "a winter visitor to the whole Empire as far south as Belgaum." I collected specimens in 1901 both at Pirmerd and the High Range and again in the low country at Alwaye in North Travancore in January, 1903.

(117) Motacilla maderaspatensis.—The Large Pied Wagtail.

Oates, No. 831 ; *Jerdon, No.* 589.

Common in the plains, but does not ascend the hills. It has a very sweet song during the breeding season at the end of the year.

(118) Motacilla melanope.—The Gray Wagtail.

Oates, No. 832 ; *Jerdon, No.* 592.

This wagtail is one of the earliest of our winter visitors and stays well on into May. It is found only on the hills from about 1,000 feet elevation upwards. It may be met with on almost every path in the forest in the neighbourhood of streams.

(119) Limonidromus indicus.—The Forest Wagtail.

Oates, No. 839 ; *Jerdon, No.* 595.

Mr. F. W. Bourdillon says of this :—" Another winter visitor, which arrives soon after and stays nearly as long as the preceding species. It is of solitary habit, and frequents open jungle in the neighbourhood of cultivation. Its note bears a considerable resemblance to that of the English chaffinch."

When I was living on the hills I often saw it, but when visiting them of late years I have not come across it.

(120) Anthus maculatus.—The Indian Tree Pipit.

Oates, No. 841 ; *Jerdon, No.* 596.

I have only seen this bird at high elevations on the hills and never in the plains. I have collected it on the High Range, and in April, 1903, I shot four specimens at Chimunji in the south at an elevation of 4,000 feet in open grass land surrounded by forest. They were in flocks and were feeding on the ground, and when disturbed took refuge in the trees after a long flight, which is jerky and dropping, and during which they uttered a single sharp note from time to time.

(121) Anthus nilgiriensis.—The Nilgiri Pipit.

Oates, No. 842 ; *Jerdon, No.* 598.

Oates gives the distribution as " the Nilgiri and Palni Hills, " but as might be expected it is also found on the High Range of Travancore. Here it is resident and fairly common in the open grass lands.

(122) Anthus cockburniæ.—The Rufous Rock-pipit.
Oates, No. 843.

This is a resident but rare bird. I have only one specimen shot at Ponmudi in August, 1900, at an elevation of 3,500 feet on a grass hill thickly strewn with rocks and boulders.

(123) Anthus striolatus.—Blyth's Pipit.
Oates, No. 846 ; *Jerdon, No.* 601.

Blyth's Pipit is a winter visitor and may be found in fairly large numbers in the dry paddy fields in February and March after the crops have been cut.

(124) Anthus rufulus.—The Indian Pipit.

A permanent resident and very numerous both in the low country in dry paddy fields and in the hills on open grass ridges in the south at all elevations, and also on the High Range.

Family ALAUDIDÆ.

(125) Alauda gulgula.—The Indian Sky-lark.
Oates, No. 861 ; *Jerdon, No.* 767.

The Indian Sky-lark is common on the High Range where I once shot one perched on the telegraph wire. It is also found in the plains where there is grass land and in dry paddy fields after the crops are cut.

(126) Mirafra affinis.—The Madras Bush-lark.
Oates, No. 876 ; *Jerdon, No.* 755.

This bird is common in the plains where it may be found in grass lands, sometimes in flocks and sometimes solitary. It is fond of perching on the ridge of a house-top whence it soars a few feet into the air, uttering a shrill trilling note in monotone. I took a nest containing a single egg in the Public Gardens on April 26th, 1902. It was placed in a depression of the ground forming a shallow cup more or less domed over. The material of the nest was mostly grass and the inside was lined with dried soft grass. The egg was somewhat elongated of a dull pale ashy-white, speckled with rusty and brown markings. It measured 19 mm. × 16 mm.

(127) Galerita malabarica.—The Malabar Crested-lark.
Oates, No. 876 ; *Jerdon, No.* 768.

I have only seen and collected this bird on the High Range at 6,000 feet elevation. Here it is fairly abundant, going about usually in small flocks. It has a very fine song, quite equal to that of *Alauda gulgula.* Unlike that bird it often sings while on the ground as well as when soaring.

(128). Pyrrhulauda grisea.—The Ashy-crowned Finch-lark.

Oates, No. 879; *Jerdon, No.* 760.

This is eminently a bird of the dry plains. At Cape Comorin, it is fairly common throughout the year. In the dry weather it frequents the paddy fields about Trivandrum, but disappears when the rains come on. I have not met with it further north.

Family NECTARINIIDÆ.

Sub-family *Nectariniinæ.*

(129) Arachnecthra lotenia.—Loten's Sun-bird.

Oates, No. 894; *Jerdon, No.* 235.

Loten's Sun-bird is fairly common in the low country and ascend the hills to 2,000 feet. All these birds are particularly partial to shoe-flowers and where these are growing they are always found.

(130) Arachnecthra asiatica.—The Purple Sun-bird.

Oates, No. 895; *Jerdon, No.* 234.

This bird is not so common as the last and I have not met with it on the hills. It frequents open country where there are bushes and also gardens. The nest is of the usual bottle-shaped type with a domed entrance. "The eggs," Mr. T. F. Bourdillon remarks, "are scarcely to be distinguished from those of *A. minima* though they are slightly larger. They recall, as Mr. Hume observes, the eggs of the sedge warbler, with this difference that they are more pointed, smaller, and have a zone of dark markings round the larger end, while they want the ink marks so often seen in the sedge warblers' eggs."

(131) Arachnecthra minima.—Small Sun-bird.

Oates, No. 900; *Jerdon, No.* 233.

Common on the hills at all elevations in the south and also on the High Range. "The nest is a pocket composed almost entirely of moss, and is usually suspended at the end of a bough at some distance from the ground. I have frequently had the eggs brought to me. They are dull-greenish or greyish-white, thickly spotted with greenish-brown, especially at the larger end, and average ·6 × ·4 in."—*T. F. B.*

They breed in December and January.

(132) Arachnecthra zeylonica.—The Purple-rumped Sun-bird.

Oates, No. 901; *Jerdon, No.* 232.

This is by far the commonest of the sun-birds. I have only seen it in the low country and never on the hills. They usually go about in pairs and congregate in flocks numbering twenty or more where there is food. The nest is the usual bottle-shaped one with a domed entrance, and the eggs are like those of the rest of the genus. They breed in February and March.

(133) Arachnothera longirostris.—The Little Spider-hunter.

Oates, No. 909; *Jerdon, No.* 224.

Oates gives the distribution of this bird as "the Western Ghats of India from the Palni Hills to about the latitude of Belgaum." It is, however, found throughout the hill range of Travancore from about 2,000 feet upwards to 5,000 feet on the High Range.

Family DICÆIDÆ.

(134) Dicæum concolor.—The Nilgiri Flower-pecker.

Oates, No. 916; *Jerdon, No.* 239.

Again Oates gives the Palnis as the southernmost habitat of this bird. It is, however, common from the foot of the hills to the summits throughout the range and is occasionally to be seen in the low country.

(135) Dicæum erythrorhynchus.—Tickell's Flower-pecker.

Oates, No. 919; *Jerdon, No.* 238.

This is not so common as the last, but is found in the same localities. A nest taken at Trivandrum on March 16th, 1902, was brought to me and contained two young birds and one fresh egg. The nest was a beautiful pear-shaped structure, 3½ inch long by 2 inches broad, with an entrance at the top: it was composed of very fine vegetable fibres mixed with down and was lined chiefly with the pappus of some flower. It was suspended from the bough of a mango tree and was almost entirely concealed by the overhanging leaves. The egg was pure white and measured 15 mm. × 10 mm.

Family PITTIDÆ.

(136) Pitta brachyura.—The Indian Pitta.

Oates, No. 933; *Jerdon, No.* 345.

This is a winter visitor and may be met with in the low country and on the hills up to 2,500 feet elevation. In the early morning and also well after sunset they may be heard whistling.

THE COLLECTIONS IN THE SOCIETY'S MUSEUM.

By E. Comber, F.Z.S.

(Read before the Bombay Natural History Society on 24th September 1903.)

The question of the collections in the Society's museum is one which requires to be brought somewhat prominently before the members at the present time, but before turning to our own collections I should like first of all to draw attention to the subject of museums in general, so that we may the more clearly try to arrive at some conclusion as to how far our collections fulfil the purposes for which they have been brought together, try to discover where our weak spots are, and to come to some decision as to how we should set about improving them. In this I shall largely avail myself of the words that have from time to time been used by one of the greatest authorities on museum management and arrangement—*viz.*, the late Sir William Flower, who was in charge of the British Museum (Natural History) for many years—for I feel that no words of mine can so clearly and concisely express the points that he was always trying to impress upon those who had the control and management of other similar institutions, whether they were the museums of large rich towns, of small villages, of scientific societies or of private individuals.

Let us see then what his advice was after his lifelong experience. On one occasion he said: "The first consideration in establishing a museum, large or "small, . . . is that it should have some definite purpose to fulfil; and the next is "that means should be forthcoming not only to establish but also to maintain the "museum in a suitable manner to fulfil that purpose. Some persons are enthusiastic enough to think that a museum is in itself so good an object that they "have only to provide a building and cases and a certain number of specimens, "no matter exactly what, to fill them, and then the thing is done; whereas the "truth is the work has only then begun. What a museum really depends upon "for its success and usefulness is not its building, nor its cases, not even its specimens—but its curator. He and his staff are the life and soul of the institution, "upon whom its whole value depends; and yet in many—I may say most of our "museums—they are the last to be thought of. The care, the preservation, the "naming of the specimens are either left to voluntary effort . . . or a grievously "undersalaried and consequently uneducated official is expected to keep in order, "to clean, dust, arrange, name and display, in a manner which will contribute to "the advancement of scientific knowledge, collections ranging in extent over "almost every branch of human learning. . . .

"Valuable specimens not unfrequently find their way into museums thus managed. Their public-spirited owners fondly imagine that they will be preserved "and made of use to the world if once given to such an institution. Their fate "is, unfortunately, far otherwise. Dirty, neglected, without label, their identity lost, they are often finally devoured by insects or cleared away to make "room on the crowded shelves for the new donation of some fresh patron of the "institution. It would be far better that such museums should never be founded. They are traps into which precious—sometimes priceless—objects fall "only to be destroyed; and what is still worse, they bring discredit on all "similar institutions, make the very name of museum a byword and a reproach, "hindering instead of advancing the recognition of their value as agents in the "great educational movement of the age."

"Now, of course, the purposes for which museums are established are two— "first the diffusion of instruction and rational amusement among the mass of "the people, and secondly, to afford the scientific student every possible means "of examining and studying the specimens of which the museum consists."

In the case of a private museum such as ours, it is of course the latter purpose that is in view, so we will see what words of advice we can gather in that direction.

"Collections for the advancement of science . . . are of value mainly in "proportion to their size, and no museum at present existing has come any- "where near what is required for the exhaustive study of natural history. "If anyone were now to endeavour to write a complete monograph of any "family in the animal kingdom, he would search in vain for materials for "doing so, not only in any one museum, but in all the museums in the world "put together." He then quotes an instance. "Soon after the arrival in our "national museum of the great and carefully selected and labelled collection "of Indian birds, presented by Mr. A. O. Hume, containing upwards of "60,000 specimens, a well-known ornithologist commenced the volumes "devoted to birds in the excellent series of manuals on the Fauna of British "India, edited by Mr. Blanford. I am told that when he began the work, "he was seen sitting at his table rubbing his hands with delight at the prospect "of success in his labours guaranteed by such an unprecedented mass of material. "But after a few weeks the scene had changed. He was pacing up and down "the room, wringing the same hands in despair at the hopelessness of solving the "tangled problems of variation according to age, sex, season and locality, the "geographical distribution, and the limits and relationship of any single species "owing to the absolutely insufficient number of properly authenticated speci- "mens at his command. Every zoologist will recognise this as a scarcely "exaggerated description of what he meets with at every step of his work."

Scientific collections cannot of course be exhibited in show cases for many reasons—the chief being the question of space and the necessity of preserving them from the deteriorating influences of light, etc., and with the very limited available accommodation that we have at present to content ourselves with, it is more than ever necessary that our collections should be made to occupy as little space as possible. Sir William Flower gave a word of warning that we may well take to heart: He said, "There is a danger of collections which "are not generally exhibited becoming neglected, and degenerating into "the condition of mere accumulations of rubbish. Anything of the kind is "absolutely incompatible with the true requirements of specimens kept for re- "search. They specially need to be arranged in an orderly and methodical "manner and to be thoroughly well catalogued and labelled, so that each may "be found directly it is wanted, and they must be frequently inspected to see "that they are free from moth or other deleterious influence."

Thus far preliminary. Let us now turn our attention to our own museum and try to see how nearly we attain to the general principles that our authority has laid down.

The first and foremost point that is of importance for the very life of the museum is the question of curator. Now Sir William Flower was speaking more or less of museums in general and public museums in particular, so that we have to some extent to modify his remarks in order to apply them to our own individual case. He emphasized the necessity of a really competent curator for the care, arrangement, etc., of the specimens in the museum. Such an individual is of course with us an impossibility, for a society of amateur naturalists, such as we are, cannot afford to spend the limited funds at its disposal on paying an adequate salary to a qualified official such as he had in his mind. Our funds—so far as they go—must be mainly devoted to the purpose on which we at present spend about half our total income: that of course, as you know, is our journal, for by it alone can we put the results of the Society's work in the hands of the large majority of our members—scattered as they are over nearly the whole globe.

We have therefore to rely upon the voluntary work of those members who are on the spot and can lend a helping hand towards bringing the collections in our museum up to a high standard of utility. Those who have had no hand in the inner working of the Society, can have no idea of the amount of real genuine hard work—congenial as it may be to those who have undertaken it from time to time—that is entailed in the curatorship of our museum, and I would specially ask you to remember in this connection that the real bulk of the duties of curator fall upon our honorary secretaries in addition to their already heavy work of looking after the Society's interests generally—in the way of strictly secretarial work—and the equally difficult task of editing the journal, which latter involves a very great deal more solid work than most of you have any idea of—and all this with the assistance of one clerk for the office part of it, and one youngster for the taxidermy department and as caretaker of the collections.

It therefore falls as a duty to the Society on those members who are resident in Bombay to provide the assistance that is absolutely necessary for the carrying out of the Society's work in the way of curatorship of the collections, and this can only be done by individual members undertaking the charge of certain departments, which idea is, as you know, contemplated in our rules by the provision of power to the Committee to appoint certain of its members to such departments as they may deem advisable. In time past we have had many such willing workers, in whose hands the collections have been developed in a way that could never have been expected under any other circumstances, with the result that other members of the Society all over the country have been encouraged to avail themselves of their opportunities for really valuable scientific work, which is represented not only by the collections we possess, but has been given to the world of science in the form of many important publications in our journal.

At the present time, however, I cannot help feeling that we are approaching a period of our existence which, if we do not succeed in securing the assistance of some more workers in this direction, may prove to be in a way a crisis in the progress of the Society. In using so strong an expression as crisis, I do not in any way wish to imply that there is any cause whatever to fear for the general well-being of the Society, but in order to impress upon the minds of those members, who have the opportunity of helping in the museum, that it is impossible for us to go ahead and extend the good work that, I am sure, you will all agree with me has continually been our record since the Society's formation. The reason is that we have at present no alternative but to recognize the fact that several of our most enthusiastic workers have, through one circumstance or another, had to discontinue their valuable work, and we have not yet succeeded in finding other members to fill their places.

We have lately lost the personal help of Mr. E. H. Aitken, who not only contributed large numbers of specimens to several of our more important collections, but helped continually with his advice in the classification and arrangement of the collections. We are now about to lose Mr. R. C. Wroughton, than whom we have had few more ardent and thorough collectors, although he was never sufficiently in Bombay to help much in the museum itself. It was only a few years ago that Captain A. J. Peile, R.A., was transferred from Bombay, who was, by his own personal work, almost entirely responsible for our collection of land and fresh water shells, for without his encouragement we should never have received the contributions we now possess. In addition to that he brought our collection of marine shells into proper order with the help of Mr. Aitken. Some time previously the short stay in Bombay of Staff Surgeon Bassett Smith, R.N., came to an end, and we had to thank him for an enormous amount of work on our collections of fishes and corals.

Now we have, as you know, lately had very satisfactory additions to our membership, both locally and generally, and I want to specially explain that it is not necessarily experienced and, what I will call, really scientific naturalists whose help we want. We cannot always find such highly qualified members as those I have just named to help us in these matters, and therefore I say don't let the younger or more inexperienced members be afraid to come forward, for there is, I can assure you, plenty of really valuable work for them to do, which will not only go towards making them, in a way, real authorities in their own lines from a scientific point of view, but will at the same time be the means of bringing much valuable material, that is at present lying waste, before the world of science. Further than that, there is no disguising the fact that many more contributions would come to us instead of going elsewhere if the owners of them felt that they would be given proper attention, worked out, and made the most of.

What I want you to realise now, and to go away and think about, is that there are many ways in which our museum is not what it ought to be, and that it is only by genuine steady work that we can hope to bring it up to the highest standard of utility, so that our collections may be made available to all our members for reference at any time and for readily identifying specimens that are sent to us for that purpose. The Committee, as you know, are anxious to develop that part of our journal devoted to "Miscellaneous Notes": these would in many instances be rendered much more valuable if the name of the particular species, to which they refer, were given. It is therefore to be hoped that members, when they send us notes, will accompany them with the specimens, or a portion of the specimens sufficient for identification, which can be done by the help of our collections.

It is quite time, I feel, that I should turn your attention to the avowed purpose with which I started this paper, *viz.*, the various collections in the Society's museum. I have already taken up so much of your time with what I intended to be preliminary remarks that I shall have to curtail what I have to say about the collections as much as possible, for you can well understand the impossibility of giving more than a general idea of how well-off we are in certain departments and how deficient in others, in the time at our disposal.

Commencing with the most highly developed animals—the mammals—we cannot of course attempt to include in our museum a collection of specimens —especially of the larger animals—for our small premises would not possibly hold one-tenth part of the material that would be required: there is the further difficulty of keeping such specimens in any sort of preservation in such a climate as this—to say nothing of the staff of assistants that any attempt to do so would entail. We have therefore to content ourselves with the sporting trophies and heads that adorn our walls—and very fine specimens some of them are too—and a small collection of representative skulls. As the larger mammals have always attracted the attention of sportsmen and naturalists, there is nothing much left to be learned from a series of fully mounted specimens, so that we do not really lose anything by their absence from our museum. If one looks over the sporting trophies in our museum one cannot help feeling regret that such a limited number of them are even possessed of a label giving the name of the animal, and fewer still have any record of the locality where and the date when they were obtained or the name of the donor. So many of our members are rather sportsmen than naturalists that these trophies are of the greatest interest to a large number of them when they come through Bombay; and as the particulars about them could mostly be gathered from the published lists of contributions in the back numbers of our journal, it would not be impossible to make good the deficiencies that I have pointed out, with a properly drawn up catalogue of what we possess, recording also the horn measurements, at any rate, of the more important specimens. Such an undertaking is more that for a sportsman than a naturalist, and we can surely find some public-spirited member who will come forward for such work.

Our collection of skulls is fairly representative so far as it goes, but as this could be largely supplemented by our 'Shikari' members if they knew what we wanted, we could probably soon add a good many if we were able to publish a catalogue of what we have at present.

For specimens of small mammals—say from the size of a squirrel downwards—we can find accommodation, but until a few years ago they were represented in our museum by a few spirit specimens of bats. We made an appeal to members for dried skin specimens, with of course skull attached, but I am sorry to say it has met with a very moderate response, though Mr. Wroughton helped us with a number of nice specimens of bats and we have lately been fortunate in having been offered valuable help by Colonel A. E. Ward. We have a few specimens of squirrels, but in rats, mice and shrews there is hardly even the nucleus of a collection. Small mammals are such simple things to skin and make into specimens, compared for instance with birds, that almost anyone can soon learn to turn out quite nice specimens, and few people have any idea of the backward state of our knowledge of the smaller mammals of India. Last year at the British Museum Mr. Oldfield Thomas appealed to me to try and get members of our Society to work in this department, pointing out how very backward the naturalists of India are compared with almost every other corner of the globe. I can assure you that there is endless original work to be done amongst the rats, mice and shrews in the immediate neighbourhood of Bombay just in the same way that there was amongst the bats when Mr. Wroughton took them up, and as you know brought to light several new species and the occurrence of several others that would never have been suspected, as recorded in our journal. Rats and mice, however, are not 'showy' specimens, and for this reason, I fancy, they so seldom attract the attention of amateur naturalists. The care of this collection has fallen to my lot, and I am somewhat ashamed to say that I have been able to devote so little time either to such collection as we have or to the encouragement of members to collect.

Passing on to the birds, I think I may say that we have a fairly representative collection of skins. Our chief contributors have been Mr. G. W. Vidal, Mr. E. H. Aitken, Mr. F. Field, Captain H. H. Harrington and Major A. Newnham. I am glad to say that they are now all arranged—so far as our limited accommodation permits—and catalogued, with the exception of two valuable collections that have lately been received from Captain H. T. Fulton from Chitral and from Captain H. Wood, R.E., from the Shan States of Burma on the Chinese frontier. After what I quoted above regarding the Hume collection at the British Museum you can well understand that there is practically no finality in a collection of bird skins, but I think we can always count upon having a number of keen ornithologists amongst our members who will go on helping us in this direction.

Our egg collection is also fairly representative, in good order and properly catalogued. There are of course many gaps that could and ought to be filled up, but you will, I am sure, be pleased to hear that one of our latest joined members—Mr. H. Macnaghten—has now taken this collection under his special care, so that we need not fear that it will do anything else but go ahead.

Of bird's nests we have a few, but they are exceptionally difficult specimens to store and keep in good condition unless it is possible to include them in properly mounted cases with their owners, and that of course we are not able to do here.

Our collection of reptiles includes of course that of our snakes, which has always had the constant care and attention of Mr. H. M. Phipson, Mr. W. S. Millard and Rev. F. Dreckmann, so that we can have small cause for dissatisfaction there. Other reptiles, although we have a fair number of spirit specimens, have never received so much attention from our members as the snakes, and it is a section that one would much like to see worked up by some enthusiast.

Of amphibians in our collection the less said perhaps the better, for although there are a certain number of spirit specimens of adult animals, they are few of them named or catalogued. We must hope that some one may be found to do this at an early date.

Next come the fishes. Here we have a large series of spirit specimens, for which we have mainly to thank Mr. Phipson and Dr. Bassett Smith. They were all named and classified by the last named some years ago, who published a complete catalogue, with some notes on them, in our journal. They mostly represent the marine species of Bombay, so that we can hardly rest satisfied with them. What I should like to see, and believe would be of considerable interest to many of our members, would be a really representative collection of the fresh-water fishes of India. There must be many anglers amongst our members who could probably contribute without much trouble and with the help of the native fishermen of their neighbourhoods. As the preservation of specimens in spirit or formalin is a simple matter, and as moderate-sized specimens will suffice, I hope the Committee will see their way to make a special appeal to members in this direction.

Of *Mollusca* I think I may say we have fair collections, for we have had amongst us here two enthusiastic collectors of marine species in Mr. Abercrombie and Mr. Aitken, and of land and fresh water species in Captain Peile, while we have also a nice series of marine species from the Andaman Islands and Aden. At the same time there are some big gaps even in our series of local marine shells that we should be able to fill up. The collections are properly arranged, and a catalogue is now in preparation.

We next come to our entomological collections, and as regards them Mr. L. C. H. Young has kindly furnished me with a few particulars. He has, as you all know, taken them most thoroughly in hand during the past two years, with the result that instead of our mass of material being scattered about in old store boxes and very nearly approaching that state of accumulated rubbish that Sir William Flower warns us against, they are now nearly all properly classified, arranged and, so far as possible, named, so that anyone requiring any individual family can lay his hand on them at once.

The collecting of insects has always been such a universally popular branch of natural history, and we have had so many really eminent entomologists amongst our members, that it is somewhat disappointing to find they are not better represented in our collections taken all round. Of *Lepidoptera* we have good representative collections of the families of butterflies containing the larger species—the gaps being nearly all rare species found only in outlying parts of the country. In the "Blues" (*Lycænidæ*) and the "Skippers" (*Hesperiadæ*) we are decidedly weak. Our principal contributors have been Colonel Swinhoe, Mr. Aitken, Lieutenant (now Colonel) Warnford and Mr. Watson in time past and latterly Lieutenant Evans and Captain Burton. Of moths we have a very miserable collection, except in a few genera containing large species, and they are practically all without any record of locality. Of *Hymenoptera* there is a fairly good collection of ants—mainly contributed by Mr. Wroughton—but in bees and wasps we are very weak, while of *Diptera* (flies, &c.) we have practically none whatever except the mosquitos lately contributed by Mr. Aitken and Captain Lyston. We once had the chance of obtaining a collection of *Diptera* through Mr. Wroughton, containing some 2,000 specimens, but as there was no one to take them in hand he felt that they would only be wasted if left in our charge and so they were sent home. This is a typical instance of what we miss if our collections are not properly taken care of. In *Coleoptera* (beetles) and all the other orders we have a lot of work before us, except in the case of the *Orthoptera* and *Rhynchota*, which are probably fairly representative though not good collections. What we want most, in order to make our collections of insects of use to members, are moths and more particularly small ones—in fact, the smaller the better. As Mr. Young is himself working up the *Orthoptera*, Dragon flies, May flies, Stone flies and White Ants, any contributions of these will be very acceptable.

Regarding the lower invertebrates, I must cut things short. We have a fair number of both spirit and dried specimens of crustaceans and some nice corals, which latter were named for us by Dr. Bassett Smith, but as we have been without an officer to take charge of this department for a number of years past there is plenty of work for anyone if we can only find the right man to take it up.

In the botanical department we have a very complete and properly arranged collection of the Bombay flora, presented to us by Mr. Woodrow, but of fungi, lichens and seaweeds I believe we have none.

A geological collection has never been undertaken, although there are a certain number of specimens stowed away in different corners. This, however, is a department that might well be taken in hand with advantage.

In conclusion, let me again appeal to all members to do their best to get their friends to realise what I have tried to prove to you, *viz.*, that our museum collections are not by any means what they ought to be, and that the only way to hope to improve them is by finding members who will take some one department under their special charge.

SYNONYMIC CATALOGUE OF THE *LEPIDOPTERA PAPILIONINA* IN THE SOCIETY'S COLLECTION.

By L. C. H. Young,

Hon. Sec., Insect Section of the Bombay Natural History Society.

I believe a complete list of the Papilionina, or Butterflies, in the Society's collection has not hitherto been published, which, I hope, will be a sufficient justification for this paper.

We have now a fairly representative collection of the Indian region proper, thanks to the generosity of our many correspondents, and, I think, it will be of interest to all collecting members to know what we have and have not got.

It will be seen that we are very poorly represented in the Hesperiadæ and those forms of the Lycænidæ (the great genus Arhopala, for instance) mostly confined to Assam and Burmah ; also that we have none of the species peculiar to Tennasserim or the Andamans. The collection has of course been limited to the Indian Empire.

I have not recorded the localities whence the specimens came ; in many, probably the majority of cases, they are unknown, though they can often be inferred, and moreover it would entail enumerating each specimen separately which considerations of space do not justify.

In the matter of synonyms I have only thought it necessary to enumerate those by which actual Indian specimens have been described in the majority of cases. A statement of opinion on the more difficult subject of the relative specific value of the various local races which have been described from different Malayan islands of most of the widely distributed species would be out of place here.

As regards the Indian forms I believe I have not differed much from the general opinion of most collectors in this country.

Fam. I. Nymphalidæ.

Melitæa. Fb.
  balbita. Mre.
Argynnis. Fb.
  lathonia. L.
  kassala. Mre.
  adippe. L.
    jainadera. B. H.
  aglaia. L. var. vitalha. Mre.
  castetsii. Oberth.
  hyberbius. Johan.
    niphe. L.
    argyrius. Sp.
    argynnis. Drury.
    tephnia. Gdt.
    aruna. Mre.
  childreni. Gray.
    sakontala. Koll.
  rudra. Mre.
Junonia. Hb.
  asterie. L.
    almara. Clk.
  atlites. L.
    laodamia. L.
  lemonias. L.
    aonis. Cr.
  hierta. Fb.
    aemone. Cr.
  orithyia. L.
Precis. Hb.
  iphita. Cr.
    intermedia. Feld.

- HESTINA. Westw.
  - nama. Dbld.
- HYPOLIMNAS. Hb.
  - bolina. L.
    - *auge. Cr.*
    - *jacintha. Drury.*
    - *aria. Fb.*
    - *charybdis. Butl.*
  - misippus. L.
    - *diocippus. Cr.*
    - *inaria. Cr.*
- SYMBRENTHIA. Hb.
  - hippoclus. Cr.
    - *daruka. Mre.*
  - hypselis. Gdt.
    - *gotinda. Mre.*
  - sitana. de N.
- VANESSA. Fb.
  - cardui. L.
  - indica. Hb.
  - canace. L.
    - *chromia. Drury.*
  - antiope. L.
  - urticæ. L. var. Kashmirensis. Koll.
  - ,, ,, rizana. Mre.
  - ,, ,, ladakensis. Mre.
- CUPHA. Billberg.
  - sinha. Koll.
  - phalanta. Drury.
  - erymanthis. Drury.
  - placida. Mre.
- CIRROCHROA. Dbld.
  - aoris. Dbld.
    - *abnormis. Mre.*
  - thais. Fb.
    - *cognata. Mre.*
- EURIPUS. Westw.
  - dichroa. Koll.
  - consimilis. Westw.
  - halitherses. Dbld.
    - *isa. Mre.*
    - *haliartus. Feld.*
- TANAECIA. Butl.
  - lepidea. Butl.
  - appiades. Ménétres.
- APATURA. Fb.
  - hordonia. Stoll.
    - *plagiosa. Mre.*
    - *sinuata. Mre.*
  - zaida. Dbld.
  - marathus. Dbld.
  - leucothoë. L.
    - *varmona. Mre.*
    - *andamana.* ,,
    - *nicobarica.* ,,
    - *disrupta.* ,,
    - *adana.* ,,
    - *meetana.* ,,
    - *swinhoei. Butl.*
    - *kassarupa. Mre.*
    - *eurymene. Butl.*
  - ophiana. Mre.
    - *martabana. Mre.*
  - jumba. Mre.
  - perius. L.
    - *nylas. L.*
    - *polyxena. Don.*
  - opalina. Koll.
  - mahesa. Mre.
    - *nanga. Mre.*
  - selenophora. Koll.
  - zeroca. Mre.
  - asura. Mre.
  - inarina. Butl.
    - *asita. Mre.*
  - cama. Mre.
  - procris. Cr.
    - *anarta. Mre.*
  - trivena. Mre.
    - *hydaspes. Mre.*
    - *lepechini. Ersch.*
  - ismène. Dbld.
    - *attenuata. Mre.*
  - nama. Dbld.
  - recta. de N.
  - franciæ. Gray.
  - teuta. Dbld.
  - lubentina. Cr.

- nais. Forst.
  - *thyelia. Fb.*
  - *alcandra. Hb.*
- garuda. Mre.
- vasanta. Mre.
- evelina. Stol.
  - *laudabilis. Sw.*
- jama. Feld.
- danava. Mre.
- anyta. Hew.
- thyodamas. Boisd.
  - *ganescha. Koll.*
- parysatis. Westw.
- cambica. Mre.

Limenitis. Fb.

- zayla. Dbld. & H.
- daraxa. Dbld.

Charaxes. Ochs.

- dolon. Westw.
- schreiberi. Gdt.
- baya. Mre.
  - *watti. Butl.*
  - *corax. Feld.*
  - *harpax. Feld.*
  - *agni. Mre.*
- athamas. Drury.
  - *pyrrhus. Don.*
  - *hamasta. Mre.*
  - *bharsita. Feld.*
  - *agrarius. Swin.*
  - *samatha. Mre.*
- aria. Feld.
- fabius. Fb.
  - *euphanes. Esp.*
- marmax. Westw.
- hierax. Feld.
  - *hipponax. Feld.*
  - *julinda. Butl.*
  - *hindia. Butl.*
- lunawara. Butl.
- aristogeiton. Feld.
  - *desa. Mre.*
- imna. Butl.
- pleistonax. Feld.
  - *khimalara. Butl.*
  - *khasiana. Butl.*

Cethosia. Fb.

- cyane. Drury.
- mahratta. Mre.
  - *nietneri. Feld.*
- biblis. Drury.

Cynthia. Fb.

- erota. Feld.
  - *salome. Swin.*
- asela. Mre.

Doleschallia. Feld.

- polibete. Cr.
  - *bisaltide. Mre.*
  - *pratipa. Mre.*

Kallima. Westw.

- inachis. Boisd.
  - *huegelii. Koll.*
  - *huttoni. Mre.*
  - *limborgii. Mre.*
  - *ramsayi. Mre.*
  - *boisduvali. Mre.*
  - *atkinsoni. Mre.*
- horsfieldii. Koll.
  - *philarchus. Westw.*
  - *alompra. Mre.*
  - *doubledayi. Mre.*
  - *mackwoodi. Mre.*
  - *wardi. Mre.*

Pseudergolis. Feld.

- nicea. Gray.
  - *dolope. Feld.*
- veda. Koll.
  - *nara. Mre.*

Dichorragia. Butl.

- nesimachus. Boisd.

Parthenos. Hb.

- virens. Mre.

Clerome. Westw.

- arcesilaus. Fb.
  - *camens. Hb.*
  - *leontius. Elp.*

Stichophthalmia. Feld.

- camadeva. Westw.

Thaumantis. Hb.

- ramdeo. Mre.

Enispe. Westw.
euthymius. Dbld.
Symphædra. Hb.
dirtea. Fb.
Discophora. Boisd.
lepida. Mre.
Melanitis. Fb.
leda. L.
ismene. Cr.
aswe. Mre.
tristis. Feld.
suryudana. Mre.
bela. Mre.
tambra. Mre.
varaha. Mre.
gokala. Mre.
duryodama. Feld.
zytenius. Hbst.
vamana. Mre.
Pareba. Dbld.
vesta. Fb.
terpsichore. Cr.
issoria. Hb.
anomala. Koll.
Telchinia. Hb.
violæ. Fb.
cephea. Cr.
Danais. Latr.
lynceus. Drury.
ilea. Dbld.
jasonia. Westw.
agarmarschana. Feld.
hadeni. W. M. & de N.
daos. Boisd.
eudoxa. Gray.
exprompta. Butl
vulgaris. Butl.
nicobarica. W. M. & de N.
aglea. Cr.
grammica. Boisd.
ceylanica. Feld.
agleoides. Feld.
tytia. Gray.
var. melaneus. Cr.
taprobana. Feld.
nilghiriensis. Mre.
limniace. Cr.
Limnas. Hb.
septentrionis. Butl.
chrysippus. L.
alcippus. Cr.
dorippus. Klug.
genutia. Cr.
nipalensis. Mre.
hegesippus. Cr.
aggresippus. Feld.
Euplœa. Fb.
rhadamanthus. Fb.
linnæi. Mre.
midamus. Auct.
coreoides. Mre.
klugii. Mre
kollari. Feld.
sinhala. Mre.
core. Cr.
vermiculata. Fp.
subdita. Mre.
asella. Mre.
esperi. Feld.
layardi. Druce.
frauenfeldii. Feld.
godartii. L.
alcathoe. Gdt.
doubledayi. Feld.
deione. Westw.
poeyi. Feld.
hopei. Feld.
binotata. Butl.
melanosticta. Butl.

Fam. II. Satyridæ.

Byblia. Hb.
ilithyia. Drury.
polinice. Cr.
Ergolis. Boisd.
merione. Cr.
cortina. Hbst.
tapestrina. Mre.
taprobana. Mdst.
ariadne. L.
coryta. Cr.

- **Elymnias.** Hb.
  - undularis. Drury.
    - *protogonia. Cr.*
    - *vinctoria. Mre.*
    - *discrepans, Dist.*
    - *nigrescans. Butl.*
    - *fraterna. Butl.*
  - caudata. Butl.
  - leucocyma Gdt.
    - patna. Westw.
    - *malelas. Hew.*
- **Mycalesis.** Hb.
  - blasius. Fb.
    - *samba. Mre.*
    - *lalassis. Hew.*
    - *larida. Butl.*
  - mineus. L.
    - *drusia. Cr.*
    - *justina. Cr.*
    - *cepheus. Butl.*
    - *perseus. Fb.*
    - *otrea. Cr.*
    - *tabitna. Fb.*
    - *zephyrus. Koll.*
    - *visala. Mre.*
    - *subfasciata. Mre.*
    - *indistans. Mre.*
  - adolphei. Guèr.
  - oculus. Marsh.
  - malsara. Mre.
    - *nicotia. Hew.*
    - *rudis. Mre*
    - *lepcha. Mre.*
    - *langi. de N.*
  - patnia. Mre.
  - junonia. Butl.
- **Orstriæna.** Wall.
  - runeka. Mre.
  - mandata. Mre.
- **Lethe.** Hb.
  - sinorix. Hew.
  - vindhia. Feld.
    - *dolopes. Hew.*
  - mekara. Mre.
  - chandica. Mre.
  - europa. Fb.
    - *beroë. Cr.*
    - *arenata. Butl.*
  - dyrta. Feld.
  - neelgherriensis. Guèr.
  - drypetis. Hew.
    - *embolina. Butl.*
    - *todara. Mre.*
  - rohria. Fb.
  - pura. Dbld. & H.
  - yama. Mre.
    - *yamoides. Mre.*
- **Orinoma.** Dbld.
  - verma. Koll.
  - sidonis. Hew.
  - maitrya de N.
  - satricus. Dbld.
  - bhadra. Mre.
    - *khasiana. Mre.*
- **Amecera.** Butl.
  - schakra. Koll.
  - menava. Mre.
- **Pararge.** Hb.
  - cashmirensis. Mre.
- **Aulocera.** Butl.
  - padma. Koll.
    - *avatana. Mre.*
  - swaha. Koll.
  - brahminus. Blanch.
    - *weranga. Lang.*
    - *scylla. Butl.*
  - saraswati. Koll.
- **Satyrus.** Fb.
  - parisatis. Koll.
  - pimpla. Feld.
  - batriva. Mre.
  - digna. Marsh.
  - cadesia. Mre.
  - shandura. Mre.
  - anthe. Dist.
- **Yphthima.** Hb.
  - philomela. Joh.
    - *baldus. Fb.*

lara. Don.
laroides. Horsf.
marshalli. Butl.
indecora. Mre.
avanta. Mre.
ordinata. Butl.
asterope. Klug.
sinha. Hew.
hübneri. Kirby.
ceylanica. Hew.
chenaui. Guèr.
ypthimoides. Mre.
robinsoni. Dist.
sakra. Mre.
nikaea. Mre.
EPINEPHILE. Hb.
davendra. Mre.
roxane. Mre.
pulchella. Feld
cheena. Mre.
interposita. Eisch.
EREBIA. Dalm.
shallada. Lang.
mani. de N.
scanda. Koll.
annada. Mre.
orixa. Mre.
hybrida. Butl.
intermedia. Mre.
casiapa. Mre.
nirmala. Mre.

Fam. III. Erycinidæ.

LIBYTHEA. Hb.
myrrha. Got.
rama. Mre
lepita. Mre.
ZEMEROS. Boisd.
flegyas. Cr.
allica. Fb.
TAXILA. Westw.
durga. Koll.
ouida. Mre.
erato. Boisd.
ABISARA. Feld.
neophron. Hew.
echerius. Stoll.
bifasciata. Mre
angulata. Mre.
abnormis. Mre.
suffusa. Mre.
fraterna. Mre.
prunosa. Mre.
fylla. Dbld.

Fam. IV. Lycænidæ.

HYPOLYCÆNA. Feld.
elegans. Druce.
LAMPIDES. Hb.
aelianus. Fb.
alexis. Stoll.
pura. Mre.
zethus. Hb
konkurka. Mre.
agnata. Druce.
optimis. Rob.
conferenda. Butl.
kandulana. Feld.
elpis. Gdt.
cærulea. Druce.
coruscans. Mre.
kankana. Feld.
pseudelpis. Butl.
subdita. Mre.
abdul. Dist.
bochus. Cr.
plato. Fb.
democritus. Fb.
nila. Horsf.
NACADUBA. Mre.
atrata. Horsf.
turaca. Mre.
prominens. Mre.
plumbeomicans. W. M. & de N.
cœlestis.
ardates. Mre.
macrophthalma. Feld.
pactolus. W. M. & de N.

Castalius. Hb.
strabo. Fb.
kandarpa. Horsf.
asoka. Koll.
platissa. His.
lithargyria. Mre.
plinius. Fb.
pulcher. Butl.
rosimon. Fb.
maimon. Fb.
naxus. Hb.
clyton. Cr.
chota. Swin.
corydon. Cr.
approximatus. Butl.
decidia. Hb.
hamatus. Hud.
interruptus. de N.
akasa. Horsf.
albidisca. Mre.
puspa. Horsf.
lavendularis. Mre.
singalensis. Feld.
huegelii. Mre.
Lycæna. Fb.
bœticus. L.
archias. Cr.
damætes. Fb.
bagus. Dist.
ariana. Mre.
stoliczkana. Feld.
sutleja. Mre.
Everes. Hb.
nyseus. Guèr.
gamra. Led.
crameri. Mre.
sigillata. Butl.
uranus. Butl.
Catochrysops. Boisd.
cneius. Fb.
pandia. Koll
ella. Butl.
patalla. Koll.
contracta. Butl.
samoa. Hs.
hapalina. Butl.
theseus. Swin.
theophrastus. Fb.
psittacus. All.
ectricatus. Butl.
nara. Koll.
venosus. Mre.
callinara. Butl.
alteratus. Mre.
laius. Cr.
caius. Fb
kandura. Mre.
varunana. Mre.
brahmina. Feld.
trochilus. Frey.
putli. Koll.
parva. Murray.
isophthalma. Hs.
gnoma. Snell.
Chrysophanus. Hb.
lysimon. Hb.
karsandra. Mre.
galba. Led.
mora. Swin.
knysna. Trim
otis. Fb.
sangra. Mre.
decreta. Butl.
indica. Murray.
lysione. Snell.
maha. Koll.
chandalla. Mre.
squalida. Butl.
diluta. Feld.
ossa. Swin.
gaika. Trim.
pygmaea. Snell.
zalmora. Butl.
hylax. Dbld.
gaura. Mre.
durma. Mre.
horsfieldii. Mre.

emolus. Gdt.
balliston. Hb.
lycænoides. Feld.
bengalensis. Mre.
lœwii. Zell.
empyrea. Frey.
chamanica. Mre.
persica. Butl.
fugitiva. Butl.
yarkundensis. Mre.
kashgarensis. Mre.
nadira. Mre.
medon. Hufn.
agestis. Wien.
allous. Hb.
astrarche. Berg.
nazira. Butl.
ilas. Low.
galathea. Blanch.
nicula. Mre.
metallica. Feld.
pavana. Koll.
panava. Westw.
kasyapa. Mre.
zeriaspa. Mre.
phleas. L.
virgaurei. Scop.
timeus. Cr.
stygianus. Butl.
baralacha. Mre.
evansii. de N.
sena. Koll.
cadma. Dbld.
androcles. Dbld.
coruscans. Mre.
langii. Mre.
tamu. Koll. var. moorei. Hew.
saphir. Blanch.
oda. Hew.
Spalgis. Mre.
epius. Westw.
Aphnaeus. Hb.
vulcanus. Fb.
etolus. Hew.
bracteatus. Butl.
tigrina. de N.
fusca. Mre.
schistacea. Mre.
hypargyrus. Butl.
ictis. Hew.
nubilus. Mre.
lunifera. Mre.
trifurcata. Mre.
elima. Mre.
karlhanus. Mre.
uniformis. Mre.
lohita. Horsf.
syama. Horsf.
peguanus. Mre.
zebrinus. Mre.
zoilus. Mre.
concanus. Mre.
lilacinus. Mre.
abnormis. Mre.
Chliaria. Mre.
othona. Hew.
eltola. Hew.
Thecla. Fb.
sassanides. Koll.
Chætoprocta. de N.
odata. Hew.
Zephyrus. Dalm.
sylla. Koll.
mandara. Doh.
Deudorix. Hew.
jangala. Horsf.
ravata. Mre.
westermannii. W. M. & de N.
schistacea. Mre.
longinus, Fb.
pseudolonginus. Dbld.
melampus. Cr.
sorya. Koll.
melastigma. de N.
epijarbas. Mre.
perse. Hew.
isocrates. Fb.
pann. Don.

Zesius. Hb.
chrysomallus. Hb.
Loxura. Horsf.
atymnas. Cr.
surya. Mre.
prabha. Mre.
arcuata. Mre.
Rathinda. Mre.
amor. Fb.
triopas. Cr.
Myrina. Gdt.
sugriva. Horsf.
freia. Fb.
etolus. Fb.
amasa. Hew.
Surendra. Mre.
quercetorum. Mre.
biplagiata. Butl.
discalis. Mre.
latimago. Mre.
Curetis. Hb.
thetis. Drury.
phœdrus. Fb.
arcuata. Mre.
œsopus. Fb.
gloriosa. Mre.
felderi. Dist.
seronis. Mre.
bulis. Dbld.
malayica. Feld.
stigmata. Mre.
angulata. Mre.
discalis. Mre.
dentata. Mre.
Arhopala. Boisd.
centaurus, Fb.
helus. Gdt.
pirama. Mre.
nakula. Feld.
perithous. Mre.
amantes. Hew.
capella. Swin.
dodonea. Mre.
asoka. de N.
chola. Mre.
adriana. de N.
fulgida. Hew.
Iraota. Mre.
maecenas. Fb.
Amblypodia. Horsf.
narada. Horsf.
taooana. Mre.
andersonii. Mre.
anita. Hew.
naradoides. Mre.
darana. Mre.
arrocana. Gesn.

Fam. V. Pieridæ.

Terias. Swainson.
laeta. Boisd.
jægeri. Men.
venata. Mre.
vagans. Wall.
rama. Mre.
palitana. Mre.
cingala. Mre.
harina.
formosa. Wall.
libythea. Fb.
rubella. Wall.
senna. Feld.
drona. Horsf.
silhetana. Wall.
uniformis. Mre.
merguiara. Mre.
helioptina. Butl.
moorei. Butl.
hecabe. L.
hecaboides. Men.
fraterna. Mre.
patuelis. Mre.
fimbriata. Wall.
curiosa. Swin.
asphodelus. Bl.
nicobarensis. Feld.
swinhoei. Butl.
apicalis. Mre.
irregularis. Mre.
narcissus. Butl.

- *simulata. Mre.*
- *templetonii. Mre.*
- *excavata. Mre.*
- *pureea. Mre.*
- *simplex. Butl.*
- Colias. Fb.
  - edusa. L.
    - *fieldii. Men.*
  - hyale. L
    - *eogene. Feld.*
    - *cana. Gr.*
    - *arida. Alph.*
    - *elissa. Gr.*
    - *erate. Esp.*
    - *hybrida. Gr.*
    - *nilgiriense. Mre.*
    - *leachii. Gr.*
    - *palæno. Hb.*
    - *anrithame. Gr.*
- Gonepteryx. Lch.
  - rhamni. L.
  - zaneka. Mre.
- Kallidryas. Boisd.
  - crocale. Cr.
    - *jugurtha. Cr.*
    - *catilla. Cr.*
    - *alcmeone. Fb.*
    - *hilaria. Cr.*
    - *jugurthina. Gdt.*
    - *titania. Th.*
    - *endeer. Boisd.*
    - *phlegeus. Wall.*
    - *flava. Butl.*
    - *pomona. Fb.*
  - pyranthe. L.
    - *chryseis. Drury.*
    - *nephte. Fb.*
    - *alcyone. Cr.*
    - *gnoma. Fb.*
    - *evangelina. Butl.*
    - *philippina. Cr.*
    - *myra. Hbst.*
    - *lactea. Butl.*
    - *ilea. Fb.*
    - *pyrene. Swains.*
    - *thisorella. Boisd.*
    - *floreta, Fb.*
- Ixias. Hb.
  - marianne. Cr.
    - *agniverna. Mre.*
    - *depalpura. Butl.*
    - *meridionalis. Swin.*
    - *nola. Swin.*
  - pyrene. L.
    - *venatrix. Wall.*
    - *evippe. Drury.*
    - *pyrenassa. Wall.*
    - *verna. Druce.*
    - *cingalensis. Mre.*
    - *andamana. Mre.*
- Teracolus. Hb.
  - faustus. Oliv.
    - *faustinus. Feld.*
    - *oliens. Butl.*
    - *solaris. Butl.*
  - fulvius. Wall.
    - *palliseri. Butl.*
    - *tripunctatus. Butl.*
    - *surya. Mre..*
  - calais. Cr.
    - *amatus. Fb.*
    - *carnifer. Butl.*
    - *kennedii. Swin.*
    - *dynamine. Khy.*
    - *modesta. Butl.*
    - *cypræus. Fb.*
  - protractus. Butl
  - puellaris. Butl.
    - *ochreipennis. Butl.*
    - *rorus. Swin.*
  - vestalis. Butl.
    - *dubius. Swin.*
    - *intermissus. Butl.*
    - *pictus. Swin.*
  - danae. Fb.
    - *sanguinalis. Butl.*
    - *dulcis. Butl.*
    - *dirus. Butl.*

        - *subroseus. Butl.*
        - *eboroides. Butl.*
        - *taplini. Swin.*
        - *inmaculatus. Swin.*
    - eucharis. Fb.
        - *pseudacanthe. Butl.*
        - *titea. Gdt.*
    - etrida. Boisd.
        - *farinus. Butl.*
        - *pallens. Butl.*
        - *punctatus. Butl.*
        - *limbatus. Butl.*
        - *purus. Butl.*
        - *bimbara. Butl.*
- HEBOMOIA. Hb.
    - glaucippe. L.
        - *callirrhœ. Fb.*
        - *australis. Butl.*
        - *javanensis. Butl.*
        - *lombokiana. Butl.*
        - *timoriensis. Wall.*
        - *phillipensis. Wall.*
        - *celebensis. Wall*
- LEPTOSIA. Hb.
    - xiphia. Fb.
- PIERIS. Schrk.
    - daplidice. L.
    - napi. L.
    - canidia. Sp.
    - brassicæ. L.
    - phryne. Fb.
        - *daphe. Mre.*
        - *pallida. Swin.*
        - *lichenosa. Mre.*
        - *evagete. Cr.*
        - *nerissa. Fb.*
        - *zeuxippus. Cr.*
        - *cassida. Fb.*
        - *coronis. Cr.*
        - *copia. Mre.*
    - nama. Mre.
        - *amba. Wall.*
        - *andamana. Sw.*
        - *liquila. Sw.*
        - *namba. Mre.*
    - libythea. Fb.
        - *ares. Sw.*
        - *retecta. Sw.*
    - zelmyra. Cr.
        - *olferna. Sw.*
        - *irvinii. Sw.*
    - hippoides. Mre.
    - latifasciata. Mre.
        - *taprobana. Mre.*
        - *aperta. Mre.*
- PRIONERIS.
    - thestylis. Dbld.
- DELIAS. Hb.
    - belladonna. Fb.
        - *horsfieldii. Gray.*
        - *sancta. Mre.*
        - *chrysorrhea. Voll.*
        - *ithiela. Butl.*
        - *berinda. Mre.*
        - *flavalba. Butl.*
        - *adelma. Mitis.*
        - *boylei. Butl.*
        - *zelima. Mitis.*
        - *hearsayi. Btl.*
        - *surya. Mitis.*
        - *patrua. Leach.*
        - *amarantha. Mitis.*
        - *lativitta. Leach.*
        - *subnubilla. Leach.*
    - eucharis. Durry.
        - *hyparete. Fb.*
        - *epicharis. Gdt.*
    - thysbe. Cr.
        - *pyramus. Wall.*
    - pasithoe. L.
        - *porsenna. Cr.*
        - *aglaia. L.*
        - *dione. Drury.*
    - discombesi. Boisd.
        - *oraia. Doh.*
        - *splendida. Roths.*
    - agostina. Hew.
    - mesentina. Cr.
        - *aurota. Fb.*

- ERONIA. Hb.
  - hippia. Gdt.
    - *pingasa. Mre.*
  - valeria. Fb.
    - *gaea. Feld.*
    - *annais. Boug.*
    - *indica. Dbld.*
  - avatar. Mre.

Fam. VI. Papilionidæ.

- PARNASSIUS. Gm.
  - jacquemontii. Boisd.
    - *himalayensis. Elw.*
    - *chitralensis. Mre.*
    - *impunctata. Butl.*
    - *nirius. Mre.*
  - epaphus. Ober.
  - hardwickii. Gray.
    - *charino. Gray.*
- LEPTOCERCUS. Swain.
  - curius. Fb.
  - meges. Z-S.
    - *virescens. Butl.*
- ARMANDIA. Blanch.
  - lidderdalii. Atk.
- TEINOPALPUS. Hope.
  - imperialis. Hope.
    - *parryiæ. Hope.*
    - *himalaicus. Roth.*
    - *imperatrix. de N.*
- PAPILIO. L.
  - agetes. Westw.
  - glycerion. Gray.
    - *paphus. de N.*
    - *mandarinus. Roth.*
    - *sikkima. Hew.*
    - *assamensis. Hew.*
  - alcibiades. Fb.
    - *antiphates. Boisd.*
    - *pompilius. Fb.*
    - *epaminondas. Elw.*
    - *naira. Mre.*
    - *nebulosus. Butl.*
    - *laestrygonum. W-M.*
  - nomius. Esp.
    - *meges. Hb.*
    - *niamus. Gdt.*
    - *pernomius. Fyhst.*
    - *orestes. Fb.*
  - machaon. L.
    - *sikkimensis. Mre.*
    - *asiatica. Mre.*
    - *ladakensis. Mre.*
  - demolius. L.
    - *erythonius. Cr.*
  - sarpedon. L.
    - *demophon. L.*
    - *teredon. Feld.*
    - *thermodasa. Swin.*
  - jason. L.
    - *telephus. Mre.*
    - *axion. Feld.*
    - *chiron. Wall.*
    - *acheron. Mre.*
    - *doson. Mre.*
    - *eurypylus. Hb.*
    - *bathycles. Elw.*
    - *mecisteus. Dist.*
  - agamemnon. L.
    - *dorylas. S.*
    - *aegistus. Cr.*
  - polictor. Boisd.
    - *peeroza. Mre.*
    - *ganesa. Dbld.*
    - *triumphator. Fruhst*
    - *significans. Fruhst.*
  - paris. L.
    - *tamilana. Mre.*
  - buddha. Westw.
  - crino. Fb.
    - *montanus. Mre.*
  - demolion. Cr.
    - *cresphontes. Hb.*
  - helenus. L.
    - *daksha. Mre.*
    - *mooreanus. Roth.*
    - *iswara. white.*
  - chaon. Westw.
    - *prexaspes. Feld.*

- pammon. L.
  - *polytes. L.*
  - *romulus. Cr.*
  - *cyrus. Fb.*
  - *astyanax. Fb.*
  - *mutius. Fb.*
  - *stichius. HL.*
  - *nicobarus. Feld.*
  - *ceylanicus. Feld.*
- aristolochiæ. Fb.
  - *polydorus. Cr.*
  - *diphilus. Esp.*
- hector. L.
- philoxenus. Gray.
  - *polyeuctes. Dbld.*
  - *dasarada. Mre.*
- agenor. L.
  - *androgeos. Cr.*
  - *alcanor. Cr.*
  - *mestor. Hb.*
  - *esperi. Butl.*
  - *phœnix. Dist.*
  - *cilix. Dist.*
- protonor. Cr.
  - *laomedon. Fb.*
- rhetenor. Westw.
  - *icarius. Westw.*
  - *alcmenor. Feld.*
- astorion. Westw.
  - *itara. Westw.*
  - *varuna. Mre.*
- polymnestor. Cr.
  - *parinda. Mre.*
- rhadamanthus. Boisd.
  - *acacus. Feld.*
- minos. Cr.
  - *pompeius. W-M.*
- darsius. Gray.
  - *amphimedon. Dbld.*
- cerberus. Feld.
  - *pompeius. Mre.*
- mahadeva. Mre.
  - *dravidarum. W.-M.*
  - *abrisa. Kby.*
- clytea. L.
  - *dissimilis. L.*
  - *echidna. de H.*
  - *panope. L.*
  - *casyapa. Mre.*
  - *onpapa. Mre.*
  - *papone. Westw.*
- macareus. Gdt.
  - *striatus. Z-S.*
  - *xenocles. Gray.*
- agestor. Gray.
  - *govindra. Mre.*
  - *gopala. Mre.*

Fam. VII. Hesperiadæ.

PAMPHILA. Fb.

- comma. L.
  - *v. dimila. de N.*
- augias. L.
- dara. Koll.
  - *maesa. Mre.*
  - *maesoides. Butl.*
  - *pseudomaesa. Mre.*

TARACTROCERA. Butl.

- mævius. Fb.
  - *sagara. Mre.*
- ceramus. Hew.
  - *v. nicevillei. Wats.*

AMPITTIA. Mre.

- maro. Fb.
  - *camertes. Hew.*
  - *v. maroides. de N.*

KERANA. Dist.

- diocles. Mre.

ASTICTOPTERUS. Feld.

- septentrionum. W. M. & de N.

ATRYTONE. Sc.

- feisthamelii. Boisd.
  - *curvifascia. Feld.*
  - *alysos. Mre.*
  - *albifascia. Mre.*
  - *restricta. Mre.*
- folus. Cr.

PARNARA. Mre.
mathias. Fb.
thrax. Led.
agna. Mre.
chaya. Mre.
meneia. Mre.
guttatus. Br. & Gr.
fortunei. Feld.
mangala. Mre.
bada. Mre.
conjuncta. H-S.
narooa. Mre.
SCOBURA. Elw. & Ed.
vindhiana. Mre.
nilgiriana. Mre.
modesta. Mre.
GANGARA. Mre.
thyrsis. Fb.
AEROMACHUS. de N.
dubius. Elw. & Ed.
IAMBRIX. Wats.
salsala. Mre.
SUASTUS. Mre.
gremius. Fb.
subgrisea. Mre.
CAPRONA. Watt.
ransonnetti. Feld.
taylorii. de N.
sura. Mre.
angulata. Feld.
CELÆNORRHINUS. Hb.
ambaressa. Mre.
flavocincta. de N.
COLADENIA. Mre.
indrani. Mre.
r. tissa. Mre.

dan. Fb.
eacus. Lati.
agni. de N.
r. fatih. Koll.
TAGIADES. Hb.
atticus. Fb.
calligana Butl.
obscurus. Mab.
distans. Mre.
alica. Mre.
meetana. Mre.
SARANGESA. Mre.
purendra. Mre.
r. sati. de N.
dasahara. Mre.
r. albicilia. Mre.
HESPERIA. Fb.
galba. Fb.
superna. Mre.
evanidus. Butl.
zebra. Butl.
hellas. de N.
lavateræ. Esp.
alceæ. Esp.
dravira. Mre.
swinhai. Wats.
altheæ. Hb.
BADAMIA. Mre.
exclamationis. Fb.
ladon. Cr.
thymbron. Feld.
HASORA. Mre.
chromus. Cr.
alexis. Mre.
ISMENE. Swains.
jaina. Mre.
fergusonii. de N.

Note.—The following species—all to be found in the Peninsular area, that is to say, India, south of the Indo-Gangetic plain, or in Ceylon—are among those of which we are most anxious to obtain specimens for the Society's Museum:—

Apatura viraja. Mre.
„ kamarupa. Mre.

Discophora lepida. Mre.
„ indica. Mre.

Erebia saitis. Hew.
Camena cippus. Feb.
„ cleobis. Gdt.
„ deva. Mre.
Pieris neombo. Boisd.
„ wardii. Mre.

Papilio demolion. Cr.
r. liomedon. Mre.
„ jophon. Gray.
r. pandyana. Mre.
mahadeva. Mre.
r. dravidarum. W-M.

We may say also that we shall be very grateful for all Hesperiadæ, as the Society's collection, besides being small and unrepresentative, consists for the most part of very poor specimens; also that we cannot have too many specimens of those genera in which the true specific distinctions are still doubtful, *e.g.*, Yphthima, the "puspa" section of Castalius Nacaduba, the Catophaga section of Pieris, and the genus Aphnæus.

FURTHER NOTES ON THE CLASSIFICATION OF INDIAN BUTTERFLIES.

BY L. C. H. YOUNG.

(1) With reference to the note on page 299 of this volume, Col. Bingham has called my attention to the fact that zayla Dbld. and daraxa Dbld. have both hairy eyes, and are therefore true *Limenitis*. This is the case, and I do not know how I came to make the mistake.

(2) ATELLA. The position given to this genus is also a mistake, the antennæ being wrongly described. I am inclined to merge the genus in *Cupha*.

(3) There are a number of Lycænids not provided for in the table published, although well distributed, if not common, in the Indian region. These the late Mr. de Nicéville classified under the genera *Arrhenopteryx*, *Maneca*, *Mota*, *Drina*, *Zinaspa* and *Camena*. I think they should all be included in one—*Camena*—a genus closely allied to *Deudorix*, but separable from it by all the species having simple eyes. In *Deudorix* they are hairy.

(4) In the former paper the various species grouped by Mr. Moore in his sub-family Danainæ were separated into two genera—Hestia and Danais—by the presence or absence of anastomosis of veins 11 and 12 in the F. W. The distinction, however, is not satisfactory, as the structure of these two veins is different in practically every species concerned; and if their close alliance in other respects be admitted, the character is evidently not sufficiently constant to justify its being used for generic purposes.

A more natural classification will be as follows:—

* 1. Apex of præcostal nervure of H. W. curved backwards or bifurcating, so as to form a more or less complete præcostal cell ... ... EUPLŒA.
Apex of præcostal nervure bent forwards, simple 2
2. ♂ Anterior tibiæ and tarsi clothed with long hairlike scales. LIMNAS.
♂ Anterior tibiæ and tarsi clothed with short appressed scales and generally fringed with thinly scattered long hairs ... DANAIS.

* Mr. Moore apparently by a clerical error states the exact reverse to be the case.

A LIST OF TRAVANCORE BATRACHIANS.

By H. S. Ferguson, F.L.S.

With Plates A, B & C.

(Read before the Bombay Natural History Society on 21st January 1904.)

There have been so far thirty-four species of Batrachians described as occurring in Travancore, three of which have not been found elsewhere as yet. They are *Rana aurantiaca*, *Ixalus travancoricus* and *Bufo fergusonii.* These have been described by Mr. G. A. Boulenger in the pages of this journal, and I have to record my grateful thanks to him for the kindly help and invaluable advice he has given to me for many years in the study of this class. Of the thirty-four species, fourteen are found in the low country, and it has been possible to ascertain the life history and development of twelve of these. They are *Rana hexadactyla*, *R. cyanophlictis*, *R. tigrina*, *R. limnocharis*, *R. breviceps*, *Rhacophorus malabaricus*, *R. maculatus*, *Microhyla rubra*, *M. ornata*, *Callula obscura*, *Cacopus systoma* and *Bufo melanostictus.* Of these the tadpole of *Rana cyanophlictis* has been described by Dr. J. Anderson in the Proceedings of the Zoological Society for 1895, page 660. Those of *Bufo melanostictus*, *Rana tigrina* and *Microhyla ornata* have been described by Captain S. S. Flower in the same Proceedings for 1896, page 911, and 1899, pp. 892 and 902 respectively. The tadpoles of the remaining eight species have not, I believe, been hitherto described. I tried on several occasions to collect and keep the tadpoles of those frogs and toads found only on the hills; but they would not bear transport to the low country, and invariably died. As I was unable to study them on the hills, and to watch their development on the spot, I have been reluctantly compelled to give up the attempt to get at the life history of the hill forms. In noting the development of the low-country ones and in describing the tadpoles I have been greatly assisted by the museum preparator, Mr. Shankara Narayana Pillay, and by the museum draughtsman, Mr. C. S. Mudaliar, who has drawn all the diagrams. The measurements and descriptions have been taken from live specimens.

ORDER: ECAUDATA.

Series: FIRMISTERNIA.

Family: RANIDÆ.

1. *Rana hexadactyla.*—This frog is common in the tanks and ponds round about Trevandrum. It is thoroughly aquatic and seems rarely to leave the water. The breeding season appears to last from July to September. I have only had the tadpoles brought to me and have not seen the eggs.

Tadpoles.—Length of body two and one-third times its width, about half the length of the tail. Nostrils much nearer the end of the snout than the eye. Eyes on the side of the head, a little nearer to the spiraculum than to the end of the snout. Distance between the eyes twice that between the nostrils, more than twice the width of the mouth. Spiraculum on the left side directed backwards and upwards, situated nearer the anus than to the end of the snout, visible above and below. Anal opening on the middle line through a transparent tube carried well back beneath the tail.

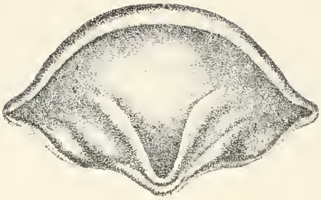
Tail.—Length three and a half times its depth, very acutely pointed. Upper crest as deep as the lower. Depth of the muscular portion half the total depth.

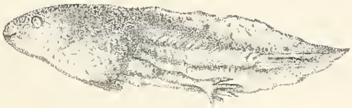
Mouth.—Beak horny, black on the edges, paler interiorly. Upper lip with one row of teeth on the edge; lower lip with two uninterrupted rows of teeth, the lower of which is on the edge. Papillæ on the sides of the lips.

Colour (in life),—Olive green, paler at the sides, with some silvery marks near the eye. Abdomen white, opaque behind, transparent with silvery dots on forepart. Tail pinkish olive, mottled and spotted with light brown. Length of body 16 mm. Length of tail 31 mm. Breadth of body 7 mm; depth of tail 9 mm. Toes completely webbed. The tadpoles are vegetable feeders in all stages, but as soon as the transformation is complete they become carnivorous.

2. *Rana cyanophlictis.*—This is one of the commonest and most abundant of frogs. Numbers may be met with at any time of the year on the borders of tanks and ponds, or floating on the surface of the water. When disturbed on the banks they jump into the water and skim along the top of it in a succession of leaps for ten or twelve yards. They can do this even when floating, but only for a yard or two. I agree with Captain Flower that *Rana tigrina* has not this habit but invariably

1.





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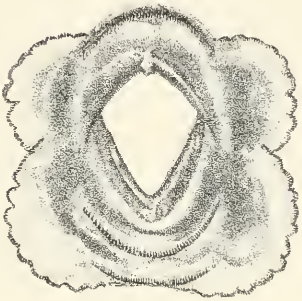

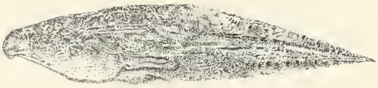

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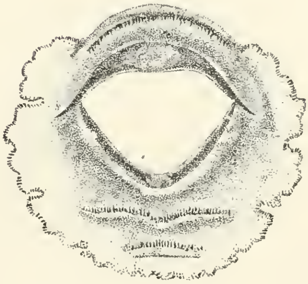

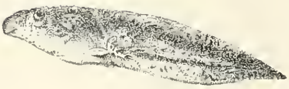

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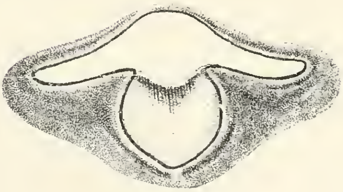
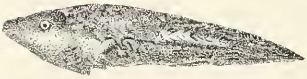


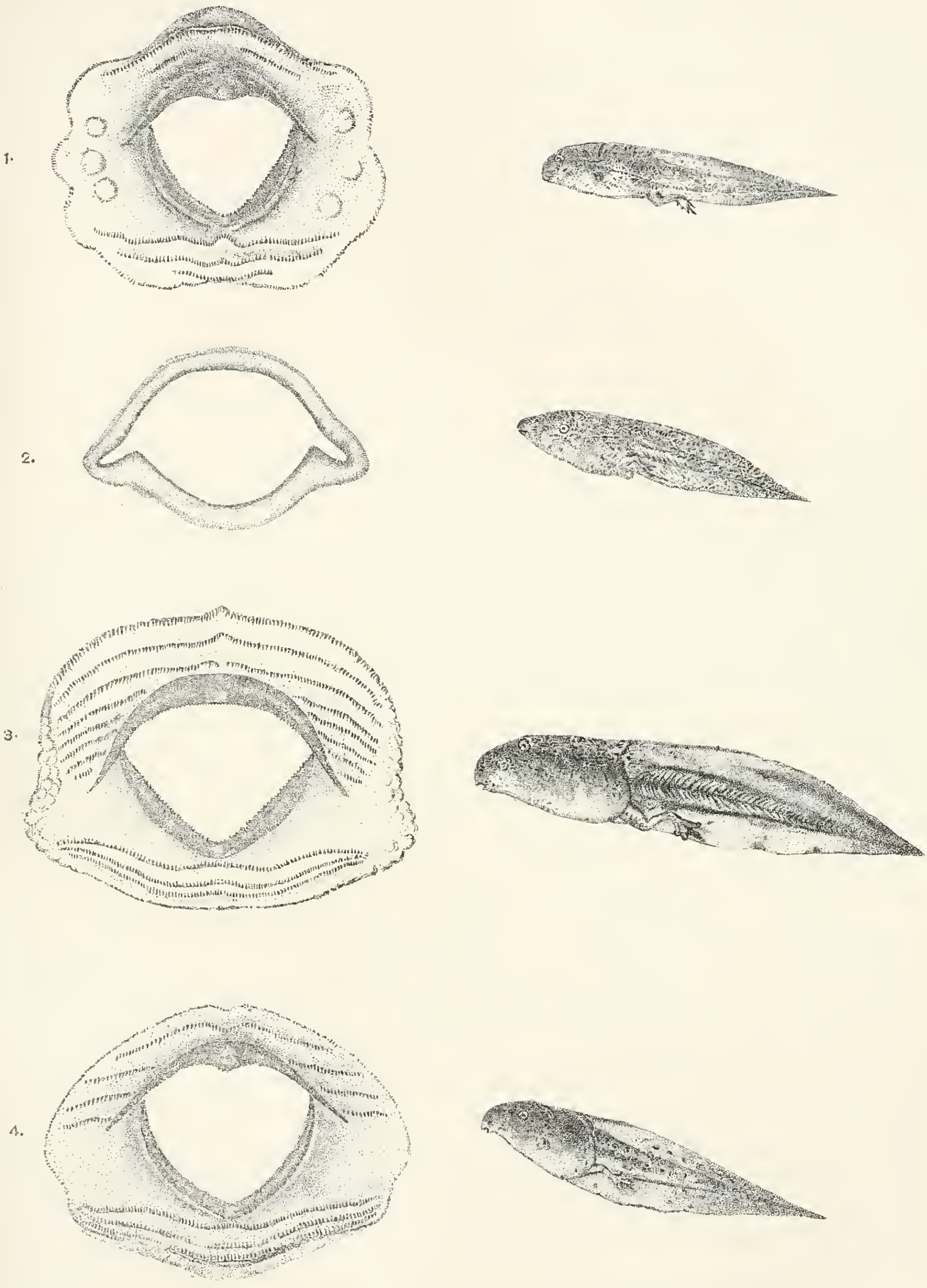


TRAVANCORE BATRACHIANS

1. CALLULA OBSCURA
2. RANA HEXADACTYLA
3. RANA LIMMOCHARIS
4. MICROHYLA RUBRA

A. P. CORTEZ & CO. LITH. BOMB.

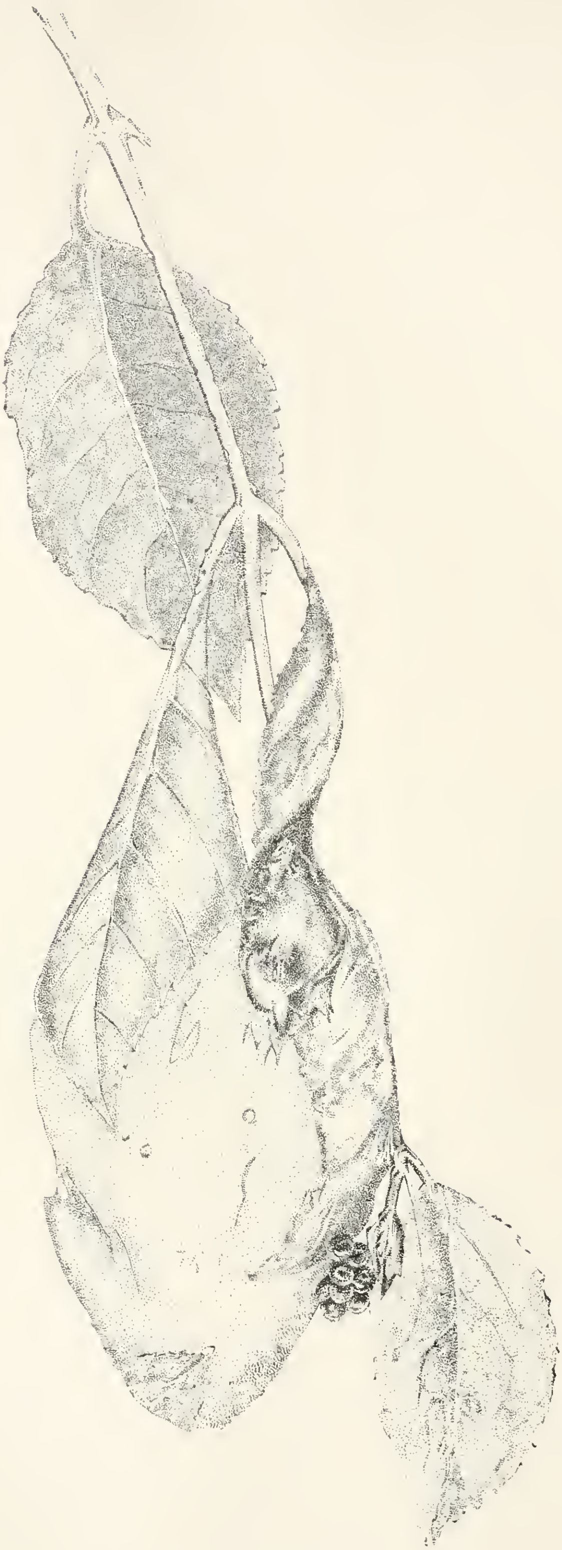
C. S. MUDALIAR DEL



TRAVANCORE BATRACHIANS

1. RANA BREVICEPS
2. CACOPUS SYSTOMA
3. RHACOPHORUS MALABARICUS
4. RHACOPHORUS MACULATUS

A. P. CORTEZ & CO. LITH. BOMB.
C. S. MUDALIAR DEL



TRAVANCORE BATRACHIANS

SPAWN OF RHACOPHORUS MALABARICUS

A. P. CORTEZ & CO. LITH. BOMB.

C. S. MUDALIAR DEL

dives if disturbed either on the bank or when floating; and I have never seen *Rana hexadactyla* perform in this way.

The tadpole has been described by Dr. J. Anderson. It varies much in size and I have always obtained the largest specimens here from ponds near the sea. In his description Dr. Anderson gives the anus as directed to the right. I have found it to be on the median line. The breeding season seems to last throughout both monsoons, as tadpoles may be found any time between June and November. The embrace is axillary, the hands of the male holding the female, which is much the larger, with the hands well dug into the axils. The eggs are deposited in paddy fields and ponds in a mass of frothy secretion. Toes of tadpoles webbed to the tips. The tadpoles feed both on water weed and on flesh.

3. *Rana verrucosa.*—I have found specimens of this frog in running water at an elevation of four thousand feet on the hills, and on one occasion obtained one in Trevandrum, but this appears to have been an exceptional occurrence.

4. *Rana tigrina.*—This fine bull-frog is very common throughout the low country. It is a regular cannibal and feeds readily on the young of its own species. In captivity it will eat raw meat and on one occasion a specimen seven inches long ate another which was hardly less in size. The breeding season begins as soon as the rains set in in May. The embrace is axillary, the hands of the male clasp the female just above, but not in the arm pits. The eggs are deposited in a frothy mass.

The tadpole has been described by Capt. Flower, but in his description of the mouth he has omitted to mention that in the mucous membrane of the upper jaw behind the beak and separated from it, there is a black heart-shaped horny area which can be seen when the mouth is well opened, also that there are similar but smaller areas at the angles of the mouth in the upper jaw. Toes nearly entirely webbed. Tadpoles are carnivorous. The variety *ceylanica* with a long inner metatarsal tubercle also occurs.

5. *Rana limnocharis.*—This is common throughout the low country, especially in paddy fields, and a variety *brevipalmata* is found on the hills. Capt. Flower says that at Singapore "it does not attempt to escape by jumping into the water, but even if touched, squats down close so is easily caught. The individuals I met at Chumar had this habit, but elsewhere, at Taiping, Bangkok, &c., I have found them very agile

and difficult to snare." I have not met with any of these supine individuals, but those I have seen have been invariably agile and anxious to escape capture.

Tadpoles may be found throughout July. Length of body two and a half times its breadth, not quite half the length of the tail. Nostrils a little nearer the end of the snout than the eye. Eyes on the sides of the head equally distant from the end of the snout and the spiraculum. Distance between the eyes twice that between the nostrils, three times the width of the mouth. Spiraculum on the left side, directed straight backwards, situated nearer the anus than the end of the snout, visible above and below, anal opening on the middle line.

Tail.—Length three and a half times its depth, obtusely pointed. Upper crest nearly twice as deep as the lower. Depth of muscular portion more than half the total depth.

Mouth.—Beak black and horny. Upper lip with one row of teeth on the edge. Lower lip with two uninterrupted rows of teeth within, the lower of which is about half the length of the upper. Papillæ moderate in size, present both on the sides and below.

Colour (in life).—Body pinkish-brown, paler at the sides with dark-brown markings, abdomen dull-white, chin more or less transparent. Tail lighter than the body with reddish-brown markings throughout.

Length of body, 12 mm. Length of tail 25 mm. Breadth of body 5 mm. Depth of tail 7 mm. Toes half-webbed.

The tadpoles are vegetable feeders in all stages.

6. *Rana breviceps.*—Fairly common in the low country. No specimens received from the hills.

Tadpoles.—Length of body one and three quarters its breadth, about half the length of the tail. Nostrils a little nearer the end of the snout than the eye. Eyes on the upper surface of the head, nearer the end of the snout than the spiraculum. Distance between the eyes one and a quarter that between the nostrils, equal to the width of the mouth. Spiraculum on the left side directed backwards and upwards, situated nearer the end of the snout than the anus, visible above and below. Anal opening on the middle line.

Tail.—Length a little more than four times the depth, acutely pointed. Upper crest nearly twice as deep as the lower. Depth of muscular portion half the total depth.

Mouth.—Beak black, horny, upper mandible with a blunt tooth-like prominence in the middle, lower finely serrated. Two rows of teeth within the upper lip, the lower of which is interrupted. Three rows of teeth within the lower lip, the outermost short, less than half the length of the middle row, which again is shorter than the upper. Short fleshy papillæ present on the sides.

Colour (in life).—Body above pinkish-brown with dark-brown spots and markings. Below greyish-white with some fine brown markings. Tail rather lighter with large dark-brown blotches, which are more numerous towards the end.

Length of body 14 mm. Length of tail 27 mm. Breadth of body 8 mm. Depth of tail 6 mm. Toes half-webbed.

7. *Rana beddomii.*—This little frog is only found in forest and usually only on the hills, but on one occasion one was found at Bombayum about ten miles from Trevandrum in the low country.

8. *Rana curtipes.*—A single specimen of this frog was taken at Pirmerd at an elevation of 3,000 feet.

9. *Rana temporalis.*—This is only found on the hills at considerable elevations. Specimens have been found at Pirmerd in Central Travancore and at Ponmudi in the south, at about 2,500 ft. elevation.

10. *Rana aurantiaca.*—A single specimen of this very pretty frog was found in Trevandrum by the museum collector in a bush. It has been described by Mr. Boulenger.

11. *Micrixalus opisthorhodus.*—Several specimens of this little frog I obtained at an elevation of 3,000 feet in a mountain stream at Chimanji in South Travancore in May. I caught several tadpoles in various stages from the same pool, but unfortunately they were placed in spirit too weak to preserve them, and the teeth were more or less rubbed away, so it was impossible to describe them.

12. *Micrixalus fuscus.*—A few specimens of this were obtained at different times from the same locality as the last.

13. *Nyctibatrachus major.*—This has been obtained only at Pirmerd.

14. *Rhacophorus malabaricus.*—This is a common frog in the low country and some times enters houses. I have often found it taking up its abode in a hanging fern basket or in an orchid pan. The breeding season lasts from June to November and tadpoles may be found in all stages between these months. The female makes a nest, usually in the neighbourhood of a pool of water. It is formed of a white frothy secre-

tion and is attached to the leaves of a tree or shrub overhanging the pool or close to it. Within twenty-four hours the outside of the nest attains a parchment-like consistency and becomes brownish in colour. The eggs are within and the tadpoles hatch out from them and feed in the nest until the external gills are absorbed. They then drop out of the bottom of the nest, and if they do not at once fall into the water they find their way to it by wriggling along. Sometimes before the outside of the nest has hardened, a species of blow-fly lays eggs in it and the maggots feed on the frogs' eggs and pass their pupa stage in the nest. The tadpoles are carnivorous from the time they reach the water.

Tadpoles.—Length of body twice its breadth, more than half the length of the tail. Nostrils equidistant from the eyes and the end of the snout. Eyes on the upper surface, situated nearer the spiraculum than the end of the snout. The space between the eyes more than once and two-fifths that between the nostrils, equal to the width of the mouth. Spiraculum on the left side directed backwards and upwards equidstant from the anus and the end of the snout, visible from above and below. Anal opening on the right when the legs first appear, in later stages on the middle line.

Tail.—Length more than three times the depth, which again is deeper than the body. The muscular portion is less than half the total depth.

Mouth.—Beak black, slightly serrated. Seven or eight rows of teeth on the upper lip, the first of which is on the edge. The first two rows are continuous, the third is narrowly interrupted in the middle, the remainder are broadly interrupted by the beak. There are three uninterrupted rows of teeth in the lower lip. Fleshy papillæ on the sides.

Colour (in life).—Body purple closely dotted with dark-brown, tail lighter. Length of body 16 mm., length of tail 26 mm., breadth of body 8 mm., depth of tail 7 mm. The tadpoles are carnivorous. The toes are nearly entirely webbed.

15. *Rhacophorus maculatus.*—The " Chunam Frog " is very common in the low country and often enters houses. It is very fond of sitting in the venetians of a door or window during the day and coming out at night to feed. It has a remarkable power of changing its colour to suit its surroundings. The breeding season lasts from June to November. The eggs are placed in pools in paddy fields or in ponds in a more or less rounded mass of frothy secretion. The basin of the fountain in the public gardens is a favourite breeding place. Sometimes

the egg mass is allowed to float free, sometimes it is fastened to the sides of the basin and sometimes it is placed on the edges clear of the water.

Tadpoles.—Length of body twice its breadth, more than half the length of the tail. Nostrils nearer the end of the snout than the eye. Eyes on the sides of the head a little nearer to the spiraculum than to the end of the snout. The distance between the eyes twice that between the nostrils and twice the width of the mouth. Spiraculum on the left side directed backwards and upwards, and nearer the anus than the end of the snout, not prominent. Anus on the right.

Tail.—Length more than three times its depth, acutely pointed, lower crest deeper than the upper, the anterior portion extending a little beyond the origin of the legs, muscular portion more than half the total depth.

Mouth.—Beak black, the upper mandible having a median tooth-like prominence, edges of both smooth, upper lip with four rows of teeth within it, the first continuous, the remaining three broadly interrupted by the beak. Lower lip with three uninterrupted rows of teeth. Papillæ absent.

Colour.—Body upper parts light yellowish green with light-brown markings, tail light pinkish. Under parts white. Caudal crests upper, grey dotted anteriorly with fine brown markings, lower crest immaculate.

The tadpoles are carnivorous. Toes more than half webbed, length of body 16 mm., length of tail 33 mm. Breadth of body 8 mm. Depth of tail 10 mm.

16. *Ixalus leucorhinus.*—This little frog has only been sent to me from Pirmerd.

17. *Ixalus beddomii.*—Only found on the high range in the north and at the summits of the hills in the south.

18. *Ixalus variabilis.*—I have only taken this frog in a swamp at Chimanji at an elevation of 3,000 feet.

19. *Ixalus chalazodes.*—I have not come across any specimens of this, but as it is recorded from Travancore I include it in my list.

20. *Ixalus glandulosus.*—Fairly common about Pirmerd.

21. *Ixalus travancoricus.*—The type of this was taken at Bodynaikanur on the high range and was described by Mr. Boulenger in Vol. VI., p. 450, of this journal.

Family.—Engystomatidæ.

22. *Melanobatrachus indicus.*—This frog is recorded from Travancore and the Anaimalai Hills, but I have not come across it personally,

23. *Microhyla rubra.*—This little frog is fairly common in the low country, but not easy to find, as it is strictly nocturnal. The breeding season lasts from June to November. The eggs are found floating in flat transparent masses; each egg is hexagonal and has a diameter of 5 mm.

Tadpoles.—Length of the body about one and a half times its breadth, less than half the length of the tail. Nostrils placed close together on the upper surface of the head, nearer the eye than the end of the snout. Eyes on the sides of the head, nearer to the end of the snout than to the spiraculum. Distance between the eyes six times that between the nostrils, two and a half times the width of the mouth. Spiraculum on the middle line opening into a transparent sheath of skin directed downwards and backwards close to the anus, which also opens in the middle line in the lower edge of the subcaudal crest.

Tail.—Length four times its depth, very acutely pointed. Lower crest twice as deep as the upper. Depth of the muscular portion more than half the total depth.

Mouth.—This has neither horny beak, labial teeth nor papillæ. The lower lip is contractile, and as Capt. Flower describes it, is continually expanding and contracting.

Colour (in life).—Body almost transparent, above reddish pink with very fine dark-brown spots, only visible as such with a lens. These form dark marks over the eyes and nostrils, and they also form a more or less diamond-shaped figure on the back. Both the crests are densely spotted towards the end. Length of body 11. Length of tail 25. Breadth of body 8 mm. Depth of tail 6. Toes at first completely webbed.

24. *Microhyla ornata.*—Like the last this frog is nocturnal, and during the day may be founl hidden under leaves or stones. It is fairly common in Trevandrum, and tadpoles may be found in June and July. They have been described by Capt. Flower. The eggs are laid in flat transparent masses. They are irregularly shaped and considerably smaller than those of *Microhyla rubra*, having a diameter of 2 mm. only. Toes at first completely webbed.

25. *Callula obscura.*—Of the habits of this little frog I can say little except that they are nocturnal. I have not found it on the hills. One specimen I found in the tin pot of a putting hole on the Residency links. I have only lately obtained the tadpoles in the month of July.

Tadpoles.—Length of body one and a half times its breadth, more than half the length of the tail. Nostrils inconspicuous, situated nearer the eye than the end of the snout. Eyes on the sides of the head, nearer to the end of the snout than to the spiraculum. Distance between the eyes more than four times that between the nostrils, more than half the width of the mouth. Spiraculum on the median line directed backwards and downwards, situated nearer the anus than the end of the snout. Anal opening on the middle line.

Tail.—Length more than twice the depth. Obstusely pointed. Upper crest about as deep as the lower. Depth of muscular portion less than half the total depth.

Mouth.—No hard beak, teeth nor papillæ.

The lower lip is more or less contractile.

Colour (in life).—Body above greenish-brown, mottled with darker brown, sides and underparts paler and without markings. Tail pinkish spotted with brown. Crests transparent, spotted with minute brown specks.

Length of body 18 mm., of tail 27, breadth of body 12 mm., depth of tail 9, toes about one-third, webbed.

26. *Callula triangularis.*—I have only obtained this at Chimanji at an elevation of 3,000 feet under stones and logs. I know nothing of its habits.

27. *Cacopus systoma.*—This burrowing frog is fairly common in the low country, but not much in evidence, as it is entirely nocturnal. The breeding season is in June and July. The eggs are globular and are placed in large irregular masses, which may be found floating in the paddy fields. As development progresses, the eggs sink.

Tadpoles.—Length of the body nearly one and a half times its breadth, more than half the length of the tail. Nostrils nearer the eye than the end of the snout. Eyes on the sides of the head nearer the end of the snout than the spiraculum. Distance between the eyes five times that between the nostrils, two and a half times the width of the mouth. Spiraculum on the median line directed downwards and backwards, situated close to and in front of the anus, which also opens in the middle line.

Tail.—Length three and a half times its depth, acutely pointed. Upper crest about as deep as the lower. Depth of the muscular portion less than half the total depth.

Mouth.—No hard beak, teeth nor papillæ.

Both upper and lower lips simple.

Colour (in life).—Body above greenish-brown, the sides lighter, mottled with white passing into greyish white below. Tail greenish-brown with darker markings. Upper crest edged with white, interrupted more or less by the dark markings. The white edge is more conspicuous on the lower crest and is continuous for the first two-thirds of its length.

Length of body 10 mm., length of tail 17 mm., breadth of body 7 mm., depth of tail 5 mm., toes slightly webbed. It is difficult to say on what the tadpoles of the Engystomatidæ feed, unprovided as they are with teeth. Their mouths are continually expanding and contracting, and I conclude that they must take in infusoria. They do not appear to search for these on water weed, but in captivity they float about in the jar in an aimless sort of way. The transparent tadpoles of the genus *Microhyla* are very delicate and are most difficult to rear. Those of *Callula obscura* and *Cacopus systoma* are not so delicate. They can be at once recognised by the spiraculum opening through a more or less transparent sheath just in front of the anal opening. Captain Flower has already pointed out that "the remarkable feature of the tadpoles" of *Microhyla ornata* is "that the hind feet are for a time completely webbed, the web is very fine and colourless; when the young frogs leave the water this web disappears." This is true also of the tadpoles of *Microhyla rubra* except that the web does not almost entirely disappear as in *M. ornata*, but persists for about a third of the length of the toes.

Series : ARCIFERA.

Family : BUFONIDÆ.

28. *Bufo beddomei.*—This little toad has been recorded from the Travancore hills by Col. Beddome. I have not come across it.

29. *Bufo melanostictus.*—This is a very common toad both on the hills and in the low country. Small specimens are very fond of taking up their abode underneath the edges of the matting in rooms on the ground floor whence they come out at dusk. The breeding season begins as soon as the first showers set in in May and lasts through June. The embrace is axillary. I have nothing to add to Capt. Flower's description of the tadpoles.

30. *Bufo parietalis.*—This fine toad is confined to the hills where it may be met with up to 3,000 feet.

31. *Bufo fergusonii.*—The type of this species was found in a hole in the parade ground in Trevandrum and was described by Mr. Boulenger in this journal (Vol. VII, p. 317) ; since then I have secured many specimens. A favourite place for them is in white-ants' nests. They are very slow in their movements and run oftener than hop. In captivity they do not seem to be at all put out by being handled. I have not as yet found the tadpoles.

ORDER : APODA.

Family : Cæciliidæ.

32. *Icthyophis glutinosus.*—Fairly common on the hills. I have not found either eggs or young.

33. *Uræotyphlus oxyurus.*—A single specimen of this was taken at Ponmudi at an elevation of 2,500 feet.

34. *Gegenophis carnosus.*—A single specimen taken at Kallaar at the foot of the hills at about 500 feet elevation.

MISCELLANEOUS NOTES.

No. I.—NOTES ON THE BREEDING OF CERTAIN BIRDS NEAR DARJEELING.

101. *Grammatoptila striata.*—This is one of the commonest of the laughing thrushes in this district. It frequents high forest, chiefly from 5 to 7,000 feet, and is found sometimes in pairs, but more often in parties, which keep more to the crowns of the trees than most of their allies. They are very noisy birds, with a variety of more or less discordant calls.

I found a nest of this species on the 7th June in a dense thicket of oak and symplocos poles and saplings in a lofty forest at about 6,500 feet.

The nest was in a fork near the top of a sapling of the latter species, about 10 feet from the ground. It is a somewhat neat but massive structure made of moss with a few bents, and lined first with twigs and then with a layer of thin brown roots.

It measures 7″ in external diameter and 6″ in height, the cavity being 3¾″ across and 2½″ deep.

The eggs, two in number, were slightly incubated. They are of a uniform rather pale, blue and fairly glossy.

They measure 1·28″ × ·91″ and 1·26″ × ·90″ respectively.

182. *Sittiparus castaneiceps.*—These little birds are common in the forests from 6,000 to 8,000 feet in these hills. They hunt in parties together with various species of Cryptolopha, Phylloscopus, Abrornis, &c.

The name Sittiparus (or better still Certhiparus proposed by Hodgson) is most appropriate, for in addition to their tit-like habits they frequently climb upon the vertical trunks of trees, clinging to the bark or moss, and searching every cranny or crevice for insects.

I found a nest of this species on the 25th May at about 6,500 feet on Mt. Tonghe. It was built up against the moss-covered trunk of a tree, 9 feet from the ground. It was domed and roughly spherical (not cup-shaped as described in the Fauna of B. I.), 6″ in diameter, and composed externally of moss followed by a layer of dry bamboo leaves and lined scantily with black hair-like rhizomorph.

This latter substance, which is often mistaken for hair or black roots, is really the mycelium of a fungus, which hangs down from the branches of trees in damp shady jungle in the form of long thin strands which are tough, black and shiny.

It is used by many kinds of birds, *e.g. Liothrix lutea,* &c., as a lining for their nests, often to the exclusion of all other substances.

The nest contained 4 rather hard-set eggs, broad ovals, white, blotched and speckled, in a dense, dark ring towards the large end, with two shades of brown, and some underlying pale purplish-black markings.

The measurements of the 4 eggs gave a mean of ·70″ × ·55″.

197. *Drymochares cruralis.*—This bird is not uncommon in the dense mossy forests from 6 to 8,000 feet. It has a pretty, short song of a few notes, which, however, end up harshly.

I found 7 nests of this species this year between the 15th June and 15th July. They were all domed structures composed entirely of moss lined with fine roots with a large opening, about 2" to 2½" across, on one side.

They were all built up against the vertical face of a moss-covered rock or tree trunk, the nest being so neatly incorporated into the mossy covering of the rock or tree that it was almost impossible to say where the nest began and where it ended. The entrance to the nest is often parallel to the face of the rock or tree and is so artfully concealed that the presence of a nest is rarely suspected until betrayed by the exit of the parent bird.

I much doubt whether this species ever builds a "shallow cup-shaped nest in brushwood" as described in "Nests and Eggs," by Oates.

The full complement of eggs is 3, though only 2 are sometimes laid.

They are long ovals, pure white, with a slight gloss.

The mean of the measurements of 15 eggs gave ·90"×·64".

201. *Tesia cyaniventris.*—This species is common up to 7,000 feet in summer, where it breeds, retiring to the warm valleys in winter. It is a great skulker, resembling the next species in its general habits.

It has a very loud short song of about half-a-dozen notes which it utters at intervals, chiefly in the spring.

I found two nests at 6,500 feet and 7,000 feet on the 5th June and 5th July respectively. They were placed in low brushwood in rather open high forest about 1 foot from the ground, and were entirely made of moss and moss roots, being domed 7" high and 5" wide and lined with a compact pad of fine moss. The entrance is a circular hole near the top, 1½" in diameter.

The eggs, 3 in one case and 4 in the other, are long ovals pale-pinkish, spotted and freckled all over, but especially at the large end, with bright chestnut in one clutch and dull brick-red in the other.

The measurements of 7 eggs give a mean of ·71" × ·50".

202. *Oligura castanei coronata.*—This pretty little bird has, like Tesia, the habits of a wren, and frequents brushwood under high forest, rarely ascending more than a few feet above the ground. It is common in the neighbourhood of Darjeeling at all elevations up to 8,000 feet, according to season, and breeds in the upper portion of its range.

It has a loud shrill call of 4 notes resembling that of *Culicicapa ceylonensis,* which it utters at intervals as it moves restlessly about in thick cover.

The accounts of the nidification of this species given by Hodgson and Jerdon are conflicting, so that I was much gratified when I found a nest this year after several seasons of fruitless search in the past.

This nest I found on the 8th July in an oak forest near the top of a ridge elevation 7,500 feet. It was woven into, and suspended from, a branchlet of *Viburnum rubescens* at a height of 3 feet from the ground. The surrounding forest was dense and the vegetation was draped with moss. No attempt had apparently been made at concealment, but the nest might easily have passed for one of the numerous similar lumps of moss sticking in the shrubs and branches of the trees.

I disturbed the bird from her nest at 5 p.m., and she returned in 20 minutes. The nest contained 2 fresh eggs.

It is neatly but rather flimsily built of moss; inside there is a layer of fine roots and lastly a scanty lining of feathers.

The eggs are long ovals, with little gloss, of an almost uniform dark terra-cotta or dull chestnut colour, duller and less uniform than the eggs of a Prinia, and with a very faint cap of mottlings of a darker shade at the larger end.

They measure ·73″ × ·52″ each.

357.—*Pnœpyga pusilla.*—This is the common wren of the temperate hill forests in these parts. Its usual note is a monosyllabic, shrill whistle which is repeated at regular intervals. This note is alternately higher and lower, with a semitone difference between the two.

I found 8 nests of this species all placed up against the vertical face of a moss-covered rock or tree. They were all exactly similar to the first type of nest described by Mr. Stuart Baker in the *Ibis*, 1896, page 322, but were never more than 3 or 4 feet from the ground and the maximum number of eggs in any nest was 3, whereas some nests contained only 2 incubated eggs.

The measurements of 10 eggs gave a mean of ·77″ × ·56″.

433. *Crptolopha burkii.*—This species is the commonest of its genus in these parts, taking the place of *C. xanthoschista* which is so common in the N.-W. Himalaya.

I found two nests on the 7th July containing, respectively, 3 and 4 fresh eggs. They were built on a steep bank at 6,500 feet in a rather open piece of forest where fellings had just been carried out. The nests are globular in shape, 4½″ in diameter, with an entrance hole 2″×1″ (twice as wide as high). They are composed externally of dry leaves, grass and moss, arched above chiefly with fine dark rootlets, and the egg cavity is lined with a thick layer of dense soft green moss. The eggs are, of course, pure white with slight gloss, and the mean of the measurements of 7 eggs gave ·61″×·47″.

444. *Tickellia hodgsoni.*—This small warbler is found, but is not common, between 6,000 feet and 8,000 feet throughout the year. Its note is a single, long-drawn, very shrill whistle, followed after an interval of 10 seconds or so by two notes, the second of which is the lower of the two.

The nest of this bird has, I believe, never been described.

I came across one on the 6th June in a thicket of saplings in a lofty forest at about 6,800 feet.

The nest was placed in a fork at the top of a symplocos sapling, 7 feet from the ground. It is roughly egg-shaped with a hole 1½″ in diameter near the top, and measures 6″ in height by 3″ in width. It is composed entirely of dry leaves (chiefly bamboo), with a lining of black rhizomorph, and, lastly, inside the latter, a second lining of bits of soft dry bamboo leaf.

The eggs, 3 in number, were nearly fresh. They have little or no gloss. The ground colour is pale claret and they are spotted, speckled, and streaked, chiefly at the large end, with darker claret markings.

The mean of the measurements of 3 eggs gives ·63″ × ·47″

447. *Horornis brunescens.*—This species is found in the Maling bamboo forests which clothe the hill sides on the Singalila range of hills from 9 to 11,000 feet. It replaces *H. fortipes* at these higher elevations, the latter species being common from 5,000 to 8,000 feet. The note of this bird is without exception the most striking and peculiar of any I have yet come across. It consists of a series of four long-drawn whistles, each lasting several seconds and each being in turn considerably higher in the scale than the one which preceded it. This is followed by a quickly repeated series of up and down notes resembling the call of *Orcocorys sylvanus* (a bird not found in these hills). I did not find the nest of this bird, but 3 eggs were brought me by an intelligent Lepcha in my employ whom I had sent up to Mt., Tonghe in search of nests of *Ianthocincla ocellata.* He brought me these eggs as being those of *H. fortipes,* which they evidently are not, firstly from the colour being quite different from that of the eggs of this bird and secondly because *H. fortipes* is not found in the bamboo forests at 9,500 feet where he obtained the eggs in question, whereas *H. brunescens* is fairly common there.

The eggs are rather broad ovals with a slight gloss, of a rather dark chestnut colour with a darker ring of markings near the large end.

The average of the measurements of 3 eggs gives ·68″ × ·50″.

I hope to be able to confirm this find next year, which of course is rather inconclusive at present.

559. *Hemichelidon ferruginea.*—This is the common flycatcher between 6 and 8,000 feet, frequenting open glades in lofty oak forest. I found 3 nests in June and July at about 7,000 feet. Two were almost inaccessible, built on slight projections caused by broken branches near the top of big dead trees, 40 or 50 feet from the ground. The third was on the side of a branch of a small tree (*Turpinia pomifera*) about 10 feet from the ground.

The nest is composed of moss lined with a mixture of white lichen and black rhizomorph. The egg cavity measures 2″ across by 1¼″ in depth.

It contained 2 fresh eggs (the other nests contained 3 young ones in each); the eggs are in shape broad ovals with slight gloss. The ground colour, where visible, is pale-green, which, however, is obscured by a uniform freckling of pale pinkish-brown markings which form a cap at the larger end.

The eggs measure ·75″ × ·57″ and ·70″ × ·56″ respectively.

887. *Æthopyga ignicauda.*—This beautiful sun bird affects higher altitudes than any other species with which I am acquainted. It is found in summer in the forests of silver fir and rhododendron between 10 and 12,000 feet, descending in winter to 6,000 feet or even lower. (I observed this species also at 11,000

feet near the head waters of the Tons river in Tehri-Garhwal—N. W. Himalaya.) In the spring and early summer it feeds largely on the honey secreted by the flowers of the various species of rhododendron found in these hills. The nidification of this species in North Cachar has been described by Mr. Stuart Baker on page 4 of Vol. X of the Journal, but as the nests and eggs therein described differ materially from mine, I think it as well to describe them. On the 27th May while descending a steep wooded slope at an elevation of 11,000 feet through a forest of silver fir, birch and rhododendron, with an undergrowth of dwarf bamboo (*Arundinaria aristata*) I came on the nest of this species suspended about 3 feet above the ground from a latteral branchlet of a bamboo which had been incorporated into the nest. It is oval in shape, 6″ high by 4″ in diameter, with a small round hole 1¼″ across near the top. It is composed externally of moss interwoven with black rhizomorph. Next comes a layer of thin pink papery rhododendron bark followed by a lining of fine grass flowers and feathers.

The eggs, 2 in number, are long ovals, white, mottled and freckled uniformly all over, with a fairly dark shade of brown.

They measure ·74″ × ·50″ and ·75″ × ·50″ respectively, which would make them almost exactly double in *volume* the eggs of this species described by Mr. Stuart Baker, which measured ·55″ × ·42″ and ·54″ × ·41″!

1105. *Cuculus saturatus*.—On the 3rd June I found the nest of *Niltava sundara* at an elevation of 6,300 feet, on a steep bank. It contained 4 eggs, 3 of the ordinary Niltava type, and one differing from these both in shape and colour which evidently belonged to some cuckoo. Again, on 13th June at 6,000 feet elevation I visited another nest of *Niltava sundara* which I had observed some days before, and found it contained a single cuckoo's egg similar to the one in the first nest. There were bits of the shell of one or more Niltava eggs lying below the nest which had presumably been ejected by the cuckoo when depositing her egg. These eggs are ellipsoidal in shape, white, with a number of minute brown specks, chiefly in a rink towards the large end.

They measured ·85″ × ·60″ and ·81″ × ·58″ respectively.

Mr. Stuart Baker, to whom I sent one of these eggs, informed me that they belonged to the above cuckoo. It seems, however, almost incredible that so large a bird should lay so small an egg.

1106. *Cuculus poliocephalus*.—This is the commonest cuckoo in these hills, especially from 5,000 to 8,000 feet. It is rare in the N.-W. Himalayas, being confined to the inner ranges near the snows, and at high elevations only between 8,000 and 11,000 feet.

On June 1st I shot a cuckoo at about 7,000 feet which turned out to belong to this species, being in the rufous phase of plumage. As she lay dying in my hand she laid an egg, which had, however, been smashed unfortunately by a pellet of shot. This egg was of a uniform pale terra-cotta colour.

A fortnight later I found a nest of *Drymochares cruralis* at 7,500 feet placed up, against a moss-covered rock in dense forest. It contained 2 eggs, one pure white belonging to the owner of the nest, and the other of a nearly uniform terra-cotta or pinkish chocolate colour similar in colour to, but darker than, that laid by the dying cuckoo.

The egg measures ·85″×·60″.

This, I think, proves beyond a doubt that *C. poliocephalus* lays a terra-cotta coloured egg.

In this connection I should like to draw attention to the description of a nest and eggs given on page 472, Vol. XI of the Journal. These belonged also, I have now little doubt, to *Drymochares* and *C. poliocephalus,* so that the latter would appear frequently to select the nest of the former in which to deposit its eggs.

Moreover, if this nest actually belonged to *Drymochares cruralis,* as seems highly probable, since the eggs and nest agree exactly with those of that species, the range of this bird must extend to the N.-W. Himalaya as far west as Simla, at high elevations.

1301. *Alsocomus pulchricollis.*—This pigeon is fairly common in the dense oak and chestnut forests between 7,000 and 8,000 feet. I found two nests in small trees about 6 feet and 10 feet, respectively, above the ground on the 21st June. They were the ordinary platform of sticks and contained each one young bird. These I brought up by hand, and they are now denizens of the Calcutta Zoological Gardens.

1312. *Macropygia tusalia.*—This is the commonest species of dove in the middle hills, about 7,000 feet. I found 6 nests during June and July, the usual platform of sticks placed in bushes or small trees a few feet from the ground.

They each contained a single egg only, in various stages of incubation, whereas in North Cachar this species appears generally to lay 2 eggs: *vide* account of nidification by Mr. Stuart Baker on page 361, Vol. X of the Journal.

The eggs found by me are also of two quite distinct types :—

Large pointed ovals—average 1·44″×1·00″
Small ellipsoid ovals—average 1·25″×0·96″

B. B. OSMASTON,
I. F. S.

5th September 1903.

No. II.—OCCURRENCE OF THE COTTON TEAL IN GUZERAT.

With reference to the Note in the last number of the Journal regarding the absence of records of the occurrence of the Cotton Teal in Guzerat, it may be of interest to record that I have shot this bird on two occasions near Baroda in December 1901, and again in February and March last, at Mahisa and Sathamba in this Agency (Mahi Kantha).

A. H. MOSSE.

SADRA, *30th August* 1903.

No. III. (*a*)—SOME PANTHER NOTES.

The following notes on two or three recent experiences may be of interest. Looking over Vol. XIV of the Journal, Mr. Bright's account of the strange behaviour of a panther reminded me of an incident which occurred last June. I was sitting up over a goat one night in the Danta State, hoping that the panther whom I expected would not turn up before the rising of the moon. He appeared and killed when the moon was just above the horizon, but obscured by a cloud: I could just see the goat, which was black and white, but could not make out the form of the murderer at all, so determined to wait for a little more light upon the scene. Unfortunately the panther did not seem disposed to humour me, and almost immediately began to try and drag the goat away. The latter not being very securely tied, I did not see the force of this proceeding and fired. The shot was followed by a dead silence for the space of a miunte or so, and I had begun to think that the panther must have been killed dead, when to my astonishment the goat began to move, and the offending cloud having just got out of the way of the moon's rays, I could dimly distinguish the outline of the panther dragging at the goat again. My first shot had been a clean miss, and had not disturbed the beast's equanimity sufficiently to make him withdraw a single step! The second shot was successful in breaking his back.

A friend of mine had an almost precisely similar experience in the adjoining district a year ago, the panther in his case merely pausing in its meal for a minute or two, after the firing of an unsuccessful shot.

One day last March, I was beating near D......for a panther, who evinced a rooted disinclination to take the line indicated for her by the beaters. Twice she contrived to break back, but was marked down again. About half-way up the hill, near the foot of which I was posted and about 90 yards distant from me, was a tall tree nearly bare of leaves, except for a few at the top. Soon after the "honk" had commenced for the third time, I caught sight of the panther as she sprang up out of the long grass into the trunk of the tree I have mentioned, then climbed, like a great cat, up to the top where she sat down quietly.

From her look-out in the tree top she watched the approaching beaters for 3 or 4 minutes, and then, having seen enough, climbed leisurely down and disappeared in the grass again. Under the circumstances, the panther's object in climbing a tree would, no doubt, ordinarily be to seek concealment: but why then select a tree, which, all but bare of leaves, was absolutely unsuited to such a purpose, more especially seeing that there were, as a matter of fact, several trees well supplied with foliage close by? I suppose it would be unscientific to express a belief that the animal's ascent into a tall bare tree, calculated to afford the best possible view, was one of deliberate choice, made with the sole and express intention of studying the disposition of its enemies!

The end of this panther was an unusual one. I had a longish shot at her, and hit her through the body, but she got away for the time being. In the course of the following night, however, she, in some way or other, contrived to fall into a well, where she was found drowned in the morning.

This is not the first instance of the kind of which I have heard, as a case was reported to me about a year ago of a panther in another neighbourhood being found drowned in a well. Of course they are comparatively thirsty-natured beasts, but a panther is not the animal that one expects to miss his footing.

The following panther story is not a personal experience, but it is perfectly authentic; the incident occurred last June not many miles from where I was in camp at the time, and the skin of the panther was brought to me a few days afterwards. Two men, Koli Thàkardas, were in the jungle, cutting wood for hut-building purposes, when a panther sprang out from among some rocks and seized one of them by the side. The boy attacked (he was about 18 years of age) did not lose his head, but grabbed the panther's jaw with one hand and one of its ears with the other, at the same time calling to his brother for assistance. The latter, a strongly-built young fellow, ran up, got astride the panther's back and smashed in its skull with a fairly heavy piece of the wood he had been cutting up! The panther, a female, must, judging from its skin, have been about 6 feet, or rather less in length. The younger of the two Kolis was rather severely mauled, and had to spend ten days in hospital; I saw them both a few days after the incident, and they were most matter-of-fact about it. They brought me, too, the bit of a shillelah with which the beast had been knocked on the head, and I have kept it as a souvenir. It was suggested that the panther might have had a family near by, which would have accounted for her unusual boldness in attacking two grown men in broad daylight, but although a search was made, no trace of any cubs was found.

In this Agency, as apparently in other districts, the after effects of the famine are manifested, in one direction, in the increase of man-eating among the tigers and panthers. While the irretrievably confirmed man-eating panther, however, is fortunately a rarity, the number of panthers that have taken to occasionally going in for a human meal is considerable. The victim is usually seized when asleep, not infrequently from inside a hut.

A. H. MOSSE.

SADRA MAHI KANTHA,
30*th August* 1903.

No. III. (*b*)—SOME PANTHER NOTES.

On the 8th February last, a Biluch lad came to the telegraph office here for treatment. He had deep wounds in the shoulder and forehead and slight scratches on back and sides. He stated he had been attacked by a panther at Rutch—20 miles to the north-east of the station—and gave the following account of his adventure:—

> "Two evenings ago, one of his father's bullocks was missing; he tracked it towards the hills till dusk, when he found it lying in a nullah, alive, but blood was oozing from a wound in its neck. Under a bush, a short distance off, he saw an animal, which in the dusk he took to be a jackal, and threw a stone at it to drive it away. The stone struck the

animal, which immediately sprang on him, knocking him down and seizing him by the shoulder. Seeing it was a panther, he lay quite still; and the animal stood over him for a short time growling, then walked away; as soon as it had got a safe distance off he got up and ran, the panther making no attempt to follow or to attack him again. He reached his village late that night and next morning the villagers visited the spot; the bullock was dead and had not been touched by the panther during the night, the latter was nowhere to be seen, and the villagers were afraid to make any attempt to find and destroy the animal."

The two wounds on the lad's shoulder were undoubtedly due to a bite; they were deep gaping wounds, with a passage underneath connecting them, showing that the teeth must have met. That on the forehead was a claw wound down to the bone, and those on body were very slight, also due to the claws of the animal.

The lad was a sturdy healthy lad about ten years of age and in a month and a half's time had quite recovered.

Panthers are occasionally killed by the Biluchis and their skins brought to the coast ports for sale, but, as a rule, the Makran-Biluch will flee at the sight of one of these animals.

W. D. CUMMING.

PERSIAN GULF, *25th July* 1903.

No. IV.—NOTES ON THE NIDIFICATION OF THE INDIAN BLACK-BREASTED RAIN-QUAIL (*CORTURNIX COROMANDELICA*).

On the 13th of July 1903 the monsoon broke in the "Hissar" District of the Southern Punjab, and a short spell of rainy weather was enjoyed. When the rain actually stopped, I at once noticed along the grassy banks of the canal and also in my garden the well-known "chip" "chip" of the Rain-Quail who is only a visitor to this part of the Southern Punjab at this time of the year. This continued up to the 17th August, when the máli commenced to cut the long grass on my front lawn.

On returning to the bungalow later the same day I found the man had left a circular tuft uncut, and on asking what this was for, he showed me a small nest formed of mud with seven eggs of the *Corturnix coromandelica* in it. Blanford, Volume IV, page 117, "Birds of India," says: "They do not make a nest but lay in a hollow on the ground." My little friend may have made the nest by turning round in the soft earth of the lawn, but the nest had a slight lip and was well formed. The next day I found the hen bird still sitting in spite of the fact that the mowing machine was being run over the cut grass and all round the isolated tuft. The máli then informed me that he wanted to flood the lawn, which is sunk for that purpose below the surrounding ground level. I suggested making a bund or dyke of mud round the tuft, and this was done and answered well, leaving the plot of grass like one of Darwin's Atoll or coral reef islands, but only 1¼ feet in diameter! On the 21st of August all the seven eggs were hatched out, the shells being opened in the neatest manner possible by a line pecked evenly all round the upper part of the egg and about ·37 of an inch from the crown. I removed all the seven eggs, and also found their tops which I have fixed on to the body, and guage the total average length to be 1·08 and diameter ·82.

They are of a dull-yellowish colour with brown or light-brownish speckles, and have a hard and comparatively thick but smooth shell substance. The seven little birds stayed in the mud nest which had been cunningly chosen, for one noticed when looking closely, the young and prickly shoots of a wild thorn bush springing up amongst the grass! The young birds did not stay long in the nest, but after the first day scattered over the island, and when the floods subsided and the mother called with a "chip" "chip," off they went to the back lawn the grass of which had not been cut! Some were caught and these freely pecked up white ants when attracted to them by scratching the ground! They constantly "chip" "chiped" standing in an erect position, and evidently waiting to hear the "chip" "chip" reply of their mother! The mother remaining in the long grass I had them all put back.

R. H. HEATH.

SIRSA, PUNJAB, 13*th September* 1903.

No. V.—THE NESTING OF (474) *LANIUS COLLURIOIDES* (THE BURMESE SHRIKE) AND (512) *ARTAMUS FUSCUS* (THE ASHY SWALLOW SHRIKE) IN UPPER BURMA.

As neither of the above birds is recorded as breeding in Burma (proper) it may be interesting to note the following:—

The Burmese Shrike.—In April 1903 out shooting, I found two nests of this bird, and saw many birds about, but had not the time to look for their nests. I found these nests in scrub jungle in the Pyawbwe District, Upper Burma. Nest and eggs the same as those found in the S. Shan States.

The Ashy Swallow Shrike.—This bird breeds plentifully in the dry jungle common in the Pyawbwe District. When out shooting in May last, I found many of their nests; most of them were inaccessible as they were built on dead trees. Some of the nests were placed in the small branches well above the thick ones, and were saucer-shaped and easily seen from below; otherwise they were exactly as described in Hume's "Nests and Eggs," *i.e.*, on broken branches and in holes.

H. H. HARINGTON, CAPTAIN.

MONYWA, 16*th September* 1903.

No. VI.—THE NESTING OF (117) *POMATORHINUS NUCHALIS* (THE TWEEDDALE SCIMITAR BABBLER).

On the 6th May 1902 at Loilem, S. Shan States, I found a Scimitar Babbler's nest containing three eggs. The bird unfortunately escaped, and deserted the nest, not coming back the next day. On a subsequent visit to Loilem I managed to shoot a *Pomatorhinus* within a quarter of a mile of the same spot. I forwarded the skin to E. C. Stuart Baker who kindly identified it for me as ♂ *P. nuchalis*. As it is highly improbable that either *Schisticeps* or *Olivaclus* inhabit the same jungle, I think it is safe to record the nesting of *P. nuchalis*. The nest was cup-shaped, composed of grass and leaf stems, and placed in a bush about 2 feet from the ground. The eggs, three in number (incubated), are glossy-white and measure about 1″ × ·72.″

H. H. HARINGTON, CAPTAIN.

MONYWA, 16*th September* 1903.

No. VII.—THE KOEL LAYING IN THE NEST OF *RICA RUSTICA*, THE MAGPIE.

As neither Hume nor Oates mentions the koël as making use of the magpie as a foster-parent, it may be worth while recording the fact. In March 1903 I got two magpies' nests: one containing three magpies and two koëls' eggs, the other five magpies and one koël's egg; in the latter case, the magpies' eggs were practically fresh (no traces of blood), while the koël's egg was well incubated, the young bird being well developed, showing that the koël's eggs must hatch out well before the foster-parent's eggs, thus giving the young koël a better chance of kicking out his young foster brothers and sisters.

H. H. HARINGTON, CAPTAIN.

MONYWA, 16*th September* 1903.

No. VIII.—BIRDS-NESTING IN GARWHAL.

The following notes on some rather uncommon nests may be of interest to some of our members. They were nearly all taken between May 24 and June 5 of this year at an elevation of between 11,000 and 13,000 feet in Garwhal.

GRACULUS EREMITA. *Red-billed Chough.*—Two nests were found in a cave on May 25 at 12,500 feet; unfortunately they had hatched out and the young birds were pretty well fledged.

ANTHUS ROSACEUS. *Hodgson's Pipit.*—There were a good many of these birds on the grassy slopes immediately above the forest and below the snow, but at first they were mostly in parties of four or five and it was not until June 2 that I found a nest with three fresh eggs at about 12,500 feet and secured the bird after a terribly cold twenty minutes in snow and rain. The same day, and not far from the first, a half-built nest of the same species was found, so I am inclined to think they were only just beginning to breed, as we had searched similar slopes very carefully without success though seeing plenty of the birds. The nest was a very neat grass nest placed at the foot of a tuft of grass close to a stream, and the eggs, which measured ·78 by ·62, were greyish white freckled and spotted all over, though chiefly at the larger end with two shades of purplish brown; on two of them there were zig-zag black hair lines.

ANTHUS MACULATUS. *The Indian Tree-Pipit.*—This pipit was quite common at a lower level than *rosaceus;* they chiefly affected the "kharaks" or grazing grounds in the forest and evidently breed rather earlier than Hodgson's pipit, as out of six nests found with three eggs in each I could only save two clutches, the others being too hard-set. These eggs get very dark-coloured, almost black, when much incubated.

SIPHIA STROPHIATA. *The Orange-gorgeted Flycatcher.*—Only two pairs of this bird were seen and one nest found (I was attracted to it by the male singing rather prettily on a tree close by) which was placed in the exposed roots of a tree, just low enough down to look into from the ground, and made of moss lined very thickly with wool and hair and a few koklas feathers under the eggs. The female was exceedingly tame and let me almost stroke her while sitting on the nest, then merely flying to a branch a few feet off. There were only two eggs, and though I gave her three days, no more were laid; they measured ·75 by ·5 and were pure white, which surprised me very much, as *Siphia parva* lays a greenish egg marked with brown.

MICROCICHLA SCOULERI. *The Little Forktail.*—One nest was found under a small bridge containing two very hard-set eggs that were with difficulty made into specimens. The nest was like that of *Henicurus maculatus* (The Western Spotted Forktail), but smaller, and was lined with only partially skeletonised leaves, whereas *maculatus* is very particular in using only perfectly skeletonised leaves in all the many nests I have seen. The eggs measured ·81 by ·59 and were white, sparingly speckled with reddish brown, chiefly at the larger end. They are not like any forktails I have seen, but probably had lost colour during incubation. The nest was about two feet above running water and in a very damp situation.

IANTHIA RUFILATA. *The Red-flanked Bush-Robin.*—One nest was found placed under a fallen tree and made of moss and leaves with a fine grass lining. It contained four fresh eggs, white without any tinge of colour and with very faint rusty red markings; in one egg the markings are barely perceptible. This was the only time this species was observed.

ACANTHOPNEUSTE VIRIDANUS. *The Greenish Willow-Warbler.*—One nest was found at about 11,000 feet; it was a little round ball of a nest placed in a grassy bank and made of moss and leaves and fine grass with an inner lining entirely composed of musk-deer hair, no other wool or hair being used. It contained three fresh eggs and one cuckoo's egg (probably *Cuculus canorus,* though unusually small) measuring ·56 by ·4, white, speckled with dark brown and pale purple, chiefly at the larger end. The cuckoo's egg measured ·81 by ·53 and was white, very sparingly speckled with light brown and pale purple.

ACANTHOPNEUSTE MAGNIROSTRIS. *The Large-billed Willow Warbler.*—This bird which I shot off its nest, I was unable to identify, but the Bombay Natural History Society has been kind enough to do so for me. The nest was entirely of moss with a very slight lining of hair and domed, although placed well inside a hole in a tree, about ten feet up. There were four fresh eggs, pure white. I found two other nests of the same species in precisely similar situations, one was deserted and one building when I had to leave; and I saw several other pairs of the bird.

HEMICHELIDON SIBIRICA. *The Sooty Flycatcher.*—This bird was exceedingly common: six nests were found quite close to the camp and I saw many more, chiefly building and only fresh eggs were found. They build a remarkably neat nest, very like an English Chaffinch's, and place it on a bough at varying heights from the ground, generally near the junction with the trunk, but not actually touching it. I saw only one nest placed against the side of a tree trunk as described in Hume's "Nests and Eggs." The male often shows the nest by feeding the female while sitting. All the eggs I saw agreed exactly with Hume's description.

NUCIFRAGA HEMISPILA. *The Himalayan Nutcracker.*—These had all hatched out and the young birds were in parties with the parents. I saw what I believe to be the nest rather high up in cypress trees.

S. L. WHYMPER.

JEOLIKOTE, U.P., 26*th September* 1903.

No. IX.—SAND-GROUSE AND LOCUSTS.

On the last day of the month of September a very large flight of Locusts (*Acridium peregrinum*) passed over the town of Sirsa coming from the Bikaneer desert and flying in a north-easterly direction. The flight appeared on the horizon in the form of a low fog bank, or sand-storm cloud, and approached at the rate of about 8 miles an hour, taking from 8-15 to 10-35 to pass over the town of Sirsa. Measurements taken of a number of the insects gave the mean average length to be 3·26 over wings and 2·60 from forehead to ovipositor. The flight passing over some open ground near the village of Khairpur, which is within a mile and a half of Sirsa, alighted in numbers and this disturbed several large flights of the common sand-grouse (*Pteroclurus exustus*) which sometimes make this their morning meeting and drinking place, the attraction being a canal that runs near and which constantly overflows and forms small lakes. The birds after being disturbed, flew about over the top of the locust cloud seemingly unwilling to leave the spot, but at the same time not liking to alight on the ground, which from the vast numbers of the insects assumed a red appearance, not unlike the red pebbly beach on some parts of the Norfolk coast or the bottom of a Surrey gravel pit. A good bag of these handsome birds was made in consequence, the sand grouse wheeling above the locusts, which kept to a height of about 40 to 50 feet above the ground. The locusts fortunately do not seem to have done much damage as far as I can ascertain, but after a short rest and feed, mostly on dry grass, passed on with the main body. A quantity alighted on a Gul Mohr tree in my garden, and when all the rest had vanished, these remained, but were soon put to flight with the aid of an old kerosine-tin vigorously beaten. The common Sand-grouse has been extremely plentiful about this part of the Punjab during the current season, commencing about the beginning of August.

It seems a pity that the villager is so apathetic about the destruction of the eggs of the locust. I am told on good authority that in response to the Government order the following is the usual form of procedure by the Lambardar of the pest-infected village :—Your petitioner reports that to-day a flight has alighted near the field of one "Kissen Singh;" the next day that they have laid eggs (these generally within an area of about 10 square yards; each female laying 108 eggs); the next "that he (the Lambardar) has destroyed the eggs!" Again a day elapses and he reports that "the flight has departed"! This may be true or not, generally the destroying part is not so! as a native dislikes destroying life, and he says to himself: "Oh! they will not bother me," "they will hatch out and go somewhere else"! "where I care not"!

October 4th.—Since writing the above I have had occasion to visit a village about 12 miles in a northerly direction from Sirsa and find that the cloud of locusts reached this place at 12-30 p.m., so that my calculation of the rate of the speed of 8 miles an hour was slightly over-estimated. After reaching this village at 12-30 they halted and did not leave again till 8 a.m. the next morning, in the meantime doing untold damage to the standing crops. I was shown "bajra" that was practically ruined, and they seem to have eaten even the bark off some trees. My informant added that the flight was 16 miles long by 7 broad and gave me the names of villages up to which they extended, as reported by the dâk runners and villagers coming into the railway station near! I think the breadth somewhat exaggerated, but the length of 16 miles would correspond with the rate of 8 miles per hour which from my calculation at the time I estimated them to be travelling at when passing over the town of Sirsa. I was also told of a "Fakir" who kept the locusts from alighting at his village by the following method :—

After catching two insects and performing ceremonies and prayers over their bodies placed under a small chattie, he gave both into the hands of a villager whom he instructed to run as hard as he could in a wide circle round the village, unlike "Lot's wife," not once looking behind him! This, I was assured, had preserved the crops, as not an insect had alighted in the enchanted area, and it was added the man had worked this miracle many times before and was well known in all the different villages about. I then asked why, being such a holy man, he did not try to clear the whole district, to which the reply was given that he was a very holy man, and did not do this "moziza" for money, but that some of the villages had *not*—in a word—come down with the needful handsomely enough. Probably these villages are now very sorry for themselves.

R. H. HEATH.

SIRSA, PUNJAB, *October* 1903.

No. X.—OCCURRENCE OF THE DWARF GOOSE (*ANSER ERYTHROPUS*) IN ASSAM.

On the 28th October I had a specimen of this rare goose sent to me for identification. It was shot by Mr. R. Johnston at Sooherating, Lakhimpur.

The bird is a young male, in very fine plumage, but the black on the breast ill-defined and in patches mixed with grey. Feet bright chrome yellow. Bill livid green, the nail still paler.

E. C. STUART BAKER.

DIBRUGARH, *9th November* 1903.

No. XI.—CANNIBALISM IN SNAKES.

In the Bombay Natural History Society's Journal, Vol. XIV, page 395, is a very interesting little note on cannibalism in snakes by Mr. W. S. Millard, in which examples of this depraved instinct are cited, the offenders mentioned being the hamadryad (*Naia bungarus*), the cobra (*Naia tripudians*), the common krait of India (*Bungarus candidus*), and the python (*Python molurus*).

I think it is generally accepted that snakes form the staple, if not exclusive, diet of the hamadryad, and there is good reason to suppose that they form the usual food in the kraits.

Günther in his "Reptiles of British India," page 342, says the Bungarus feeds on "small mammals, lizards, small snakes, and toads," but I believe snakes will be found to be more generally ingested. In support of this view I will quote the following :—

Günther in the same work alluded to above, page 344, says he has found "uropeltides" in the stomach of the Ceylon krait *(Bungarus ceylonicus)*, and Mr. Blyth in "Ceylon" by an old officer, Vol. II, page 196, refers to Dr. Günther finding a uropeltis inside a Ceylon krait. Major G. H. Evans, in a note in the B. N. H. S. Journal, Vol. XIV, page 599, mentions a banded krait (*Bungarus fasciatus*) eating a common paddy-field snake (*Tropidonotus piscator*).

In the B. N. H. S. Journal, Vol. X, page 7, Mr. Ferguson says of the krait (*Bungarus cœruleus*) or, as it is now known, (*Bungarus candidus*), that it feeds readily on snakes, and mentions one occasion when it devoured another snake made captive with it, and records another killed with the tail of a rat-snake protruding from its jaws.

Mr. F. B. Simson in "Letters on Sport in Eastern Bengal," page 246, narrates finding a banded krait (*Bungarus fasciatus*) with a snake nearly as large as itself inside it.

Cannibalism is, I believe, a distinctly unusual trait in the character of other snakes, but I have collected a few examples which I subjoin.

In Trichinopoly in 1896 I had a cobra (*Naia tripudians*) brought to me dead, killed in the well of the 23rd Madras Infantry Mess, which had nearly completed swallowing a common brown tree-snake (*Dipsadomorphus trigonata*). Mr. S. S. Flower in the Proc. Zool. Soc., Lond., December 1st, 1896, page 894, mentions a cobra (*Naia tripudians*) swallowing another snake (*Macropisthodon rhodomelas*). The same observer in the Proc. Zool. Soc., Lond., May 16th, 1899, page 680, records a tree-snake (*Dipsadomorphus dendrophilus*) having swallowed another tree-snake (*Chrysopelea ornata*) rather longer than itself.

The same observer in the same Journal, page 684, says he has known the dhaman (*Zamenis mucosus*) eat a snake (*Chrysopelea ornata*).

In the B. N. H. S. Journal, Vol. XIII, page 352, Captain G. H. Evans and I record an earth-snake (*Xenopeltis unicolor*) devouring a snake (*Tropidonotus stolatus*).

In the same volume, page 534, I record a tree-snake (*Dipsadomorphus multimaculata*) falling a prey to a companion species with which it was placed in captivity.

In the B. N. H. S. Journal, Vol. X, page 10, Mr. Ferguson mentions a rat-snake, presumably *Zamenis mucosus*, eating another when in captivity, both creatures having struggled with the same victim (a frog).

Mr. Buckland in "Curiosities of Natural History," page 182, relates having seen in the Zoological Gardens in London an English snake (*Tropidonotus natrix?*) in the act of swallowing a French species, and remarks that the snake swallowed was about the same size of the swallower.

F. WALL, CAPTAIN, I.M.S.

CANNANORE, 10*th November* 1903.

No. XII.—THE OCEANIC, OR ANDAMAN TEAL (*NETTIUM ALLIGULARE*).

I received some time ago from the Indian Museum a male skin of this species with a patch of white on the hindneck; otherwise the bird is in normal plumage, having a white patch on the lores and round the eye. I can find no record of either Mr. Finn or anyone else having found white feathers in the same place.

CHAS. M. INGLIS.

BAGHOWNIE FACTORY, 20*th November* 1903.

No. XII (*b*).—THE OCEANIC, OR ANDAMAN TEAL (*NETTIUM ALBIGULARE*).

In the Fauna of British India, Birds, Vol. IV, p. 445, Dr. Blanford states, as regards the distribution of this bird, that it occurs only on the South Andaman Island and that it has not been observed on the North Andaman, the Cocos, or the Nicobar Islands. I myself shot several specimens on the Great Cocos Island as recently as June last, some of which were young birds, and the native manager of the plantation on that island states that the bird is common there all the year round. I have also shot this bird on Landfall Island, which is, strictly speaking, the most northerly island of the Andaman group. I have always found the birds wherever a fresh-water lagoon existed, and I do not think there is any doubt that the bird is general both on the Andaman and Cocos Islands, where the above condition exists.

N. F. WILSON,
Commander, R.I.M.S. "Canning."

BOMBAY, *3rd October* 1903.

[NOTE.—Further information regarding the distribution of this duck is most useful, as few persons have had an opportunity of observing it. An interesting note on its habits, &c., was contributed to our Journal by Mr. A. L. Butler and is quoted by Mr. E. C. Stuart Baker under the heading of this species in his paper on "The Indian Ducks and their Allies" (Vol. XII., p. 259), where he also refers to a specimen that was shot at Bassein, Burma, the skin of which was identified by Mr. F. Finn, it having probably been driven there during some storm, having ventured too far out to sea from the Andamans.

E. COMBER, F.Z.S.,
Honorary Secretary, Bird Department,
Bombay Nat. Hist. Soc.].

No. XIII.—ON THE PENIS OF RUSSELL'S VIPER.

In a paper I wrote on the snakes of China, Japan, and the Loo Choo Islands* I remarked on the bifid character of the copulatory organ of a small viper (*Ancistrodon blomhoffii*). I do not know whether the peculiarity has been observed before, but I can find no allusion to it in my snake literature. To-day I had brought me a large (3′-7″) male Russell's viper (*Vipera Russellii*) killed last night. On investigating the genitals I found a precisely similar condition. Each penis (for snakes, like lizards, are doubly endowed) is subdivided, the main stem, when the organ is protruded, being about half an inch in length. I send you the specimens dissected out. The organ of one side is invaginated as it would be during the act of coition. I have never observed this peculiarity in other snakes. Is it a viperine characteristic?

F. WALL, CAPTAIN, I.M.S.

CANNANORE, *1st December* 1903.

No. XIV.—NOTE ON YOUNG FISHING CAT (*FELIS VIVERRINA*).

On Sunday, the 8th November, whilst out snipe shooting near here, I discovered a kitten of the fishing cat (*Felis viverrina*) in its native home. The lair was placed close to a tidal backwater of the river, on the ground among reeds about two feet high, and consisted of a small beaten-down patch where mother and offspring had evidently been in the habit of nestling together. From this proceeded, in two opposite directions, very distinct beaten-down paths, reminding one of hare runs on down lands in England.

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* Which appeared in the Proceedings of the Zoological Society of London, February 1903.

A single, shivering, helpless, little kitten was the sole occupant of the nest, and no parent could be found in the immediate vicinity though searched for. One could not refrain from marvelling at the extreme helplessness of a creature brought into the world like this. The eyes were open. I argue from the well beaten-down tracks and lair that the kitten had been born some days, and yet beyond exerting its claws, and making feeble attempts to stick them into my hands as I carried it, it was quite powerless to offer resistance, or make an attempt at scape.

I brought it home with me, and as it was unable to lap, have had it fed with a spoon, and am pleased to find it thriving well. It very soon took kindly to its altered conditions of life, and now follows the servants about the house and allows itself to be handled by anyone without fear or remonstrance,—in fact has become quite a welcome addition to the household. It utters a rather piercing monosyllabic cry reminding one closely of the call of a chick much accentuated. I notice Blanford in the Mammalian Volume of "the Fauna of British India" makes no mention of the young of this species.

I am surprised to notice in this connection that no mention of the state of the eyes at birth of the Felidæ is made in Blanford's work on Mammalia, nor is any allusion to this made in an excellent article on the Felidæ in Chambers' Encyclopædia.

F. WALL, Captain, I. M. S.

Cannanore, 24*th November* 1903.

No. XV.—THE MANIPUR BUSH-QUAIL, OR HUME'S BUSH-QUAIL (*MICROPERDIX MANIPURENSIS*).

The specimen mentioned by Oates and by Blanford (Fauna of British India, Vol. IV, pages 122-3) is evidently the quail shot by me in the cold weather of 1885-86 at Alipur Duar.

On more than one occasion I put up a couple of quail when tracking a tiger in long grass, and realized that they were new to me. The male was a lovely little bird, resembling a miniature black partridge it seemed to me, and both birds had a habit of flinging themselves headlong into the tall grass, in an apparently reckless manner, possibly with the object of forcing a way to the ground through the grass. After I had got the tiger, I went after the quail. I missed the male, but dropped the hen bird. I could not get the cock to rise again and feared I had wounded him.

I sent the skin to Mr. Wood Mason, who was unable to identify it, but agreed with me that it was a bird not mentioned in "Hume and Marshall's" book. He told me he had sent the specimen home to Mr. Bowdler Sharp, of the British Museum.

The birds lived within a mile or so of the Rest House, and were found in the long grass to the north-east of the Sub-Divisional Officer's house. I heard nothing more about my specimen, and could get no trace of it until I read the description in Oates' book. As the bird is so rare I think you may consider it worth while to note these particulars, and it will probably lead to other specimens being found in the same locality. I imagine they are (or were) regular visitors to these quiet haunts and are probably spread over various parts of the Duars.

H. B. THORNHILL, Lt.-Col.

November 7th, 1903.

No. XVI.—LOCUSTS IN GUJARAT.

A recent article in the *Times of India* gave the impression that the locust which invaded the Bombay Presidency, a month or two back, in such large numbers, was the "Bombay" species, the yellow-striped *Acridium succinctum.* An interesting letter from Mr. Young, which followed the article, also stated that specimens which had been sent for identification to the Society in 1901 from Gujarat, were all of this species. It may, therefore, be of interest to state that the insects which visited this Agency (Mahi Kantha) in October last were of that more notorious species *Acridium peregrinum,* as were the swarms that invaded the neighbouring British Districts of Prantij and, I believe, Kaira and Ahmedabad. I know that some specimens sent from Ahmedabad to the Government Entomologist at Surat were identified by that gentleman as being *A. peregrinum.*

A point of interest was the undecided course of flight taken by the swarms, which coming in the first instance from a north-westerly direction, circled round and moved backwards and forwards, with the result that in several instances in these districts the same place would seem to have been visited two or three times by the same swarm. I am not aware that there was any strong or changeable wind at the time which might account for these vagaries.

Considerable damage was done in some places, the crop that suffered most being the *ripe or ripening* bajri.

The one large flight that I saw myself near Sadra (on the 14th October) was flying, at about midday, in a *south-westerly* direction, at a rate of, I should say, about seven miles per hour.

The front of the swarm was about $\frac{3}{4}$ mile in breadth and its length I estimated at from six to seven miles. The depth perpendicularly was generally from 20 to 30 feet, the lowest individuals flying at not more than 8 feet from the ground, but here and there rose columns some hundreds of feet into the air. The great bulk went on steadily until lost to sight, but a certain number stopped to feed for half an hour or so in a field of jowari, eating only the grain which was nearly ripe. I intended to try whether blank ammunition would have the effect of moving them on, but they did not stay long enough for me to make the experiment.

A. H. MOSSE.

Camp Vao, Mahi Kantha,
12th December 1903.

No. XVII.—EXTRAORDINARY COURAGE OF A PANTHER.

I think perhaps the following account of a panther may be of some interest, as it seemed to me rather extraordinary. I was sitting up over a goat last April, near a village called Conapur, Indur District. It was a windy night, half moon and rather cloudy. A panther killed my goat about 8-30 p.m., and while he was lying over it I fired two barrels at him from a Paradox. Unfortunately I missed him and he stood up, but did not move a yard away. Directly he had settled down to the goat again, which was almost immediately, I fired another two barrels at him and missed again, whereupon he jumped up and trotted away for about 20 yards, but I could see him the whole time and he was back again at the goat in less than a minute. This time in my hurry I put two of the empty cartridges I had just fired into the Paradox and clicked them off. This put him off more than the explosions had done, as he galloped away, but was back again in about two minutes. I again fired two barrels and hit him badly, the second shot eventually getting him about 11 a.m. next morning. He was a full-grown male, measuring as he lay 7′ 1″, particularly fat and in very good condition. He had killed and taken away a goat from the same village two days before, so could not have been really hungry. I found all five shots next morning: two of them had hit the goat, one was about a foot short, the other two about a yard over it. As the panther each time that I fired was lying on the far side of the goat, all shots must have been unpleasantly close. The goat could not have been more than 12 yards away from me and I was on quite a low banyan tree, with little cover. I have missed three or four panthers at night, but have never known one come back again. Considering the point-blank range, it seems quite extraordinary that a panther should take so little notice of four barrels and two miss fires. Could you let me know if panthers are in the habit of coming back so soon after being fired at, and if you have ever heard of a similar case.

L. C. BRODIE.

TRIMULGHERRY, DECCAN,
December 1903.

No. XVIII.—OCCURRENCE OF *SARCOGRAMMUS INDICUS* (THE RED-WATTLED LAPWING) IN THE DIBRUGARH DISTRICT, UPPER ASSAM.

In view of the fact that Blanford gives the distribution of *Sarcogrammus indicus* on the east to Sylhet and Cachar and states that it is not recorded from Upper Assam I record the occurrence of an adult female. This bird, a single, was obtained on a sandy bank on the River Debra, a short distance above here, on the 5th December.

H. STEVENS.

RUNGAGORA, UPPER ASSAM,
December 1903.

No. XIX.—OCCURRENCE OF *HOREITES BRUNNEIFRONS* (THE RUFOUS-CAPPED BUSH-WARBLER).

In the Dibrugarh District, Upper Assam, Oates gives the eastern limit in distribution of *Horeites brunneifrons* as Sikhim, and Blanford's observations as 10,000 feet, the lowest limit in its range. It is, however, a common cold-weather visitant to the plains in this district, almost invariably found near water, preferably frequents stretches of ekra, hopping from stem to stem a few feet from the ground, uttering its unmistakable note, and occasionally taking a short flight into any secluded nook, remarkably tame, a contrast to the skulking habits of the numerous babblers which frequent similar localities. It is also to be found along the banks of forest streams where the undergrowth and dead branches seem equally suited to its requirements.

H. STEVENS.

Rungagora, Upper Assam,
December 1903.

No. XX.—BUTTERFLIES OF THE KONKAN DISTRICT.

In order to make our records as complete as possible, I think it well to notify the capture of two males and one female of *Apatura* (*Eukalia*) *lubentina* and one male and one female, *Leke neelgherriensis*, on the Andheri-Marol road in Salsette. In the case of both species the males were good specimens, while the hindwings of the females were notched, evidently by a bird's beak.

I have also to record the capture of a fresh specimen of *Caprona ransonnettii* Feld in the same locality, which I believe is new to the list.

L. C. H. YOUNG.

Bombay, 18*th December* 1903.

No. XXI.—ENEMIES OF INSECTS.

I have seen it stated recently in print, and there seems to be a general idea that the food of dragonflies consists of minute insects only, and it may therefore be well to state that I have frequently seen them eating *Mycalesis mineus* and *Yphkima huebneri*—I suppose our two commonest butterflies.

Recently I found green locusts on the dinner table making a meal off several small moths. I had no idea before that these creatures were very carnivorous.

L. C. H. YOUNG.

Bombay, 18*th December* 1903.

No. XXII.—OCCURRENCE OF THE COMMON INDIAN BEE-EATER (*MEROPS VIRIDIS*) IN BALUCHISTAN.

I am able to add one more to Captain Marshall's list of the birds of Quetta, published in recent numbers of the Society's Journal. I saw yesterday a specimen of *Merops viridis* sitting on a poplar tree. I was quite close to it at the time, and am certain of the identification. I had not previously seen a specimen of this species in Baluchistan, though Blanford states that it extends through Baluchistan to Persia. It is certainly not common here.

C. G. NURSE, MAJOR,
113th Infantry.

QUETTA, 17th December 1903.

No. XXIII.—THE ENEMIES OF BUTTERFLIES.

Major Nurse has referred to this point in the last number of this Journal; my experience has been that butterflies are seldom preyed upon as other flying insects are. I have seen an Attid spider catch a small butterfly and apparently suck it dry before dropping it; in the West Indies the common lizard, *Anolis*, Sp., certainly preys on butterflies, eating the body and dropping the wings. Dragonflies never appear to catch butterflies, and it would be interesting to know whether *Mantidæ* and *Locustidæ* prey on butterflies; the latter are said to.

H. MAXWELL LEFROY.

SURAT, 21st December 1903.

No. XXIV.—A NOTE ON THE HABITS OF *CHLORION* (SPHEX) *LOBATUS*.

A female of this species was observed in a Calcutta compound digging in a grass-plot. The insect was hard at work excavating in loose soil, raking the soil away with her forelegs and jaws. As fast as it was dug out, the earth was thrown behind her between her legs. In a few minutes she began to disappear below the surface, emerging continually with a load of earth; this she carried in her forelegs and jaws below her head, and on reaching the surface it was thrown behind her. This continued till the insect had penetrated a little over an inch below ground. A miniature eruption then occurred and a fine large cricket leapt out in a cloud of dust closely followed by the wasp. There was no doubt that the cricket was badly frightened and was doing all it could to get away. It had no chance; the wasp was after it at once, jumped on its back, and seized it firmly round the thorax. Her abdomen curled round the body of the struggling cricket and the sting was inserted several times into the thorax, just where the big nerve ganglia lie. The cricket struggled violently and dislodged the Chlorion, but she again got a firm hold and repeatedly stung it in the middle ventral line of the thorax. Finally the cricket collapsed, only the twitchings of the limbs showing it still lived. The Chlorion then left it and flew about till she found a hole, which proved to be one of the openings of the cricket's own burrow. This hole she explored and then returned to the cricket. She placed herself upon it, seized it in her jaws and legs, and with the aid of her wings dragged it to the opening. Then both vanished for some time and the wasp presently re-appeared alone. She covered the hole neatly up with earth and flew away. This little tragedy was now repeated with the difference that the cricket this time burst out at one hole and the wasp at another. The result was the same. After the second burying, the wasp was captured as she emerged, and put in a cage with a live cricket. Next morning both were dead but the cricket had a small white egg stuck between the base of its legs. Even in a cage she had been true to her instincts and stung the cricket, afterwards laying her egg as she had done with the crickets she caught the day before under natural circumstances. The cricket proved to be *Brachytrupes Achatinus* (Stoll.), the common big ground cricket. The grub of the Chlorion presumedly feeds on the paralysed cricket which keeps alive and fresh till wanted.

H. MAXWELL LEFROY.

SURAT, 21*st December* 1903.

No. XXV.—ABNORMAL GROWTH OF TREES.

In two cases I have come across I have noted a very abnormal growth in tree trunks. In both cases the trees are worshipped by the local Uriyas.

1. *Terminalia tomentosa.*—A large tree near Chirikipadasasanum in the Atagoda Zemindari of the Ganjam District.

Girth 1 foot above ground ...	13 feet.
Girth 9 feet above ground ...	17 feet,
Largest diameter at 9 feet ...	8 feet.
Smallest diameter at 9 feet ...	1 foot.

2. *Anogeissus acuminata.*—In Tilsingi village, Gumsur Taluq, Ganjam.

A very old tree, buttressed all round ; the main trunk broken short at a height of 12 feet, with three large side branches, the whole presenting the shape of a gourd.

Girth at 2 feet above ground ...	39 feet.
Diameters at right angles ...	12 feet 4 inches and 12 feet.

The abnormal thickness is mainly due to five large buttresses which are from 3 to 6 feet high and stand out from 1½ to 3 feet away from the main trunk.

The girth measurement was taken round the buttresses from apex to apex and not following the sinuosities.

C. E. C. FISCHER,
DY. CONSERVATOR, I. F. S.

CHATRAPUR, GUNJAM DIST., MADRAS PRESY.,
January 1904.

No. XXVI.—SOME NOTES ON HARRIER HAWKS IN UVA, CEYLON.

One evening, just when the building of the Boer Camp at Diyatalawa was being commenced, a friend and I were trying the swamps in the vicinity for snipe.

It was getting dusk and we were surprised to see a much larger number of Harrier Hawks (*C. cineraceus* and *C. macrurus*) than we had ever observed in company before settling on the low hills surrounding a swamp. They came in from all sides as the light waned, until there were quite forty. We shot seven specimens, three of *C. cineraceus* and four of *C. macrurus.* When it was nearly dark all the hawks settled in the swamp, which was covered with low thick grass and about five acres in extent.

On going into the swamp we found that each bird had a regular "form" very similar to that made by a covey of partridge where they pass the night. A boy who had been an inmate of the "Happy Valley Home" (a school and reformatory established by the Wesleyan Mission) which used to be close by assured us that the hawks had been in the habit of passing the night in this particular swamp for years; and that the boys used to catch them with dogs on moonlight nights; rather a poor game for the dogs one would think! It may be a coincidence, it is most certainly a fact, that when the camp was inhabited and the swamp drained, these birds became scarce.

Before the camp was built, any one on these "palnas" could hardly look round without seeing a harrier quartering the ground methodically as it sailed gracefully along, and I have not observed more than could be counted on the fingers of one hand in the last two N.-E. monsoons.

This fact is the more strange, as there are literally hundreds of lonely swamps in the "palnas" between Badulla, Attampettia and Bandarawela.

As a matter of fact the very swamp chosen by the birds must have been often shot over, though I presume the hawks escaped observation owing to the fact of their only coming in at nightfall.

There were no examples of the (in Ceylon) rare Pied Harrier (*Circus melanoleucus*) with the other two species, although I have occasionally seen one in the striking mature plumage gliding along out of shot.

It is curious how deceptive a harrier's flight is. I once saw one chasing a snipe, not swooping but "raking" after it; the snipe after vain endeavours to escape by speed had to seek refuge in some scrub.

F. SIKES.

BADULLA, CEYLON,
21*st December* 1903.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 5TH NOVEMBER 1903.

A meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 5th November 1903, Colonel R. H. Light presiding.

NEW MEMBERS.

The election of the following new members was announced:—Mr. John J. Robinson (Ceylon); Mr. S. M. McCausland (Bombay); Mr. T. D. Moore (Bombay); Mr. E. H. Hart (Parel); Mr. H. Wright (Ceylon); Mr. G. H. Dempster (Mhow, C.I.); Colonel H. B. Thornhill (Simla); Lieut.-Colonel J. B. Dodd (Poona); Colonel W. Capper (Simla); Captain A. S. Begbie (Cawnpore); Captain R. B. Graham (Rangoon); Mr. A. B. de Souza (Hyderabad, Sind); Mr. C. B. Beadnell (Kanuparte, Ongole District, Madras); Dr. R. J. L. Sladen (Igatpuri); Mr. Ralph Bagnall (Ootacamund); Mr. R. R. Wright (Bombay); Mr. F. C. Annesley (Bombay); Mr. C. E. Rhenius (Bellary); Mr. P. F. S. Creaghe (Kirkee); Lieutenant P. Hudson (Rangoon); Captain S. de V. A. Julius (Delhi); Mr. J. Lee Stewart (Belur, Hassan District, Mysore); Major J. H. Christie (Kasauli, Punjab); and Mr. E. Marsden (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. H. M. Phipson, acknowledged receipt of the following contributions since last meeting:—

Contribution.	Description.	Contributor.
1 Barn Owl (alive)* ...	*Strix flammea*	Mr. Narayenji Dwarkadas.
1 Snake (alive) juv	*Tropidonotus stolatus* ...	Mr. T. S. Dawson.
1 Chameleon (alive) ...	*Chameleon calcaratus* ...	Mr. D. G. Ommaney.
1 Turtle, juv (alive) ...	....	Do.
1 Brown Tree Snake (alive).	*Dipsas trigonata*	Mrs. E. T. Davies.
1 Painted Snipe	*Rostratula capensis* ...	Mr. N. C. Macleod.
1 Bengal Red Whiskered Bulbul (alive).	*Otocompsa emeria*	Mrs. E. B. Raikes.
1 Green Tree Snake (alive),	*Dryophis mycterizans* ...	Rev. F. Dreckmann, S.J.
1 Green Tree Viper (alive),	*Trimeresurus gramineus* ...	Do.
1 Dhaman (alive)	*Zamenis mucosus*	Do.
1 Large Centipede (alive)...	*Scolopendra gigantea* ...	Dr. H. Cogill.
Some land shells from the Garo Hills, Assam.	....	Mr. Jas. Marten.
1 Snake	*Lycodon aulicus*	Mr. C. H. Donald.
A number of Geological Specimens from Ajmere.	....	Mr. Lalla Har Swarup.
1 Daboia or Russell's Viper (alive), from Goona, C.I.	*Vipera russellii*	Capt. S. Capper.

* Sent to Victoria Gardens.

MINOR CONTRIBUTIONS.

From Professor O. V. Muller, Mr. R. S. Pearson, Mrs. K. Thomson, Mr. E. C. B. Acworth, Colonel G. M. Porter, R. E., Captain Morphew, R. A. M. C., Mr. J. Brand, and Mr. M. F. Reid, C. I. E.

CONTRIBUTIONS TO THE LIBRARY.

Flora of the Presidency of Bombay, Part III. By Theodore Cook, C.I.E., presented by the author.

Records of the Botanical Survey of India, Volume II, No. 5, in exchange.

Report on the administration of Government Museum and Connemara Public Library, Madras, for 1902-3, in exchange.

Hand List of Birds, Volume IV, and Monograph of Mosquitoes; three volumes and index, in exchange.

PAPERS READ.

The following papers were then read and discussed :—(1) Description of three new frogs from Southern India and Ceylon, by G. A. Boulenger, F. R. S (Vice-President, Zoological Society of London). (2) On two Dolphins from Madras, by R. Lydekker, B.A., F.R.S., F.G.S. (3) Sand-grouse and Locusts, by R. H. Heath C. E. (4) The use of Calmette's antivenomous serum in cases of snake-bite, by Major W. B. Bannerman, I. M. S.

Major Bannerman demonstrated his remarks with carefully prepared tables, showing the great difference between the action of the poisons of the cobra (*Naia tripudians*), the daboia or chain viper (*Vipera rusellii*) and the banded krait (*Bungarus fasciatus*). The action of the poison in the case of the Hamadryad or king cobra (*Naia bungarus*) is now being worked out by Captain G. Lamb, I. M. S., at Kasauli from venom obtained from the live specimen now in the Society's museum. Major Bannerman pointed out that in the absence of material it was at present impossible to make experiments with the venom of the Phoorsa or Kupper (*Echis carinata*) and the common krait (*Bungarus cœruleus*), and he hoped that members of the Society and others would forward live specimens of the last mentioned snakes so as to enable further experiments to be carried out. He also mentioned that it has now been proved beyond doubt that Calmette's anti-venine, although of the greatest value in the case of cobra bite, is useless in the case of bites from the banded krait and the daboia.

Colonel R. Light moved a vote of thanks to Major Bannerman, I. M. S., and the authors of the other papers, and in doing so remarked on the great value and public utility of such a paper as Major Bannerman's, and also of the experiments which were being carried out by Captain Lamb, I. M. S., at Kasauli. It was to be devoutly hoped that Government would encourage this work, and that in the course of time the different cera would be found which would prevent the great loss of life which at present takes place annually in India from snake-bite.

A vote of thanks to the Chairman then terminated the meeting.

PROCEEDINGS
OF THE MEETING HELD ON
17TH DECEMBER 1903.

A meeting of the members of the Bombay Natural Society was held at the Society's Rooms on 17th December 1903, the Rev. Father Dreckmann, S. J., presiding.

NEW MEMBERS.

The election of the following new members was announced :—Life member: Mr. H. W Seton-Karr (London). Members: Major C. Gough (Babugarh, U. P.); Dr. Francis L. Penno, M.R.C.S., L.R.C.P., and L.S.A. (Bombay); Mr. R. Guy Foster (Bilur, Hassan District, Mysore); Mr. O. F. Lumsden, I.C.S. (Jhelum, Punjab); Mr. F. W. Allison, I.C.S. (Rajkote); Shrimant Maloji Rao Rage Ghorpade, Chief of Mudhol (Mudhol, S. M.C.); Mr. H. P. Stringfellow (Bombay); Lieutenant F. M. Bailey (Tibet Frontier Commission); Mr. R. Wallace (Bombay); Mr. H. L. Richardson (Bombay); Mr. R. Foulkes (Madura); Mr. J. F. Grant (Nazira, Assam); Mr. P. B. Haigh, I.C.S. (Karwar); Mr. G. C. Alston (Maskeliya, Ceylon); Captain C. P. Porch (Lucknow); Mr. C. A. Beyts, I.C.S. (Karachi); Mr. F. C. Griffith (Hyderabad, Sind); Lieutenant A. M. Twiss, R. E. (Kirkee); Captain E. S. Gale (Aijal, Lushai Hills, Assam); Lieutenant R. A. Yule (Silchar, Assam); Mr. D. H. Lees (Tezpur, Assam); Mr. V. Subramanyam, M.A. (Salem, Madras); Mr. R. H. Sears, C. E. (Barakar Bridge, E. I. Railway); and Mr. H. M. M. Davidson (Behali P. O., Darrang, Assam).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. H. M. Phipson, acknowledged receipt of the following contributions since last meeting :—

Contributions.	Description.	Contributors.
3 Snakes, from the Aden hinterland.	....	Lieut. W. S. Patton, I.M S.
1 Snake	*Trop. plumbicolor*	Dr. B. Sladen.
1 Rufous Fantail Warbler...	*Disticola cursitans*... ...	Capt. G. A. Hawks.
1 Indian Monitor (alive) ...	*Varanus bengalensis* ...	Col. R. H. Light.
1 Common Sand-grouse ...	*Pterocturus exustus* ...	Mr. R. H. Heath, C.E.
A number of mounted Butterflies.	....	Mrs. K. Thomson.
Head of a Ganges Crocodile.	*Gavialis gangeticus* ...	Lt. W. H. B. Salmon.
1 White-winged Wood-Duck.	*Asarcornis scutulatus* ...	Mr. Hannynton.
A number of Shells... ...	....	Mr. J. A. Betham.
Minor contributions ...	....	Mrs. Owen Dunn.

CONTRIBUTIONS TO THE LIBRARY.

The Fauna of British India, Hymenoptera, Vol. II, by Colonel C. T. Bingham, from the author.

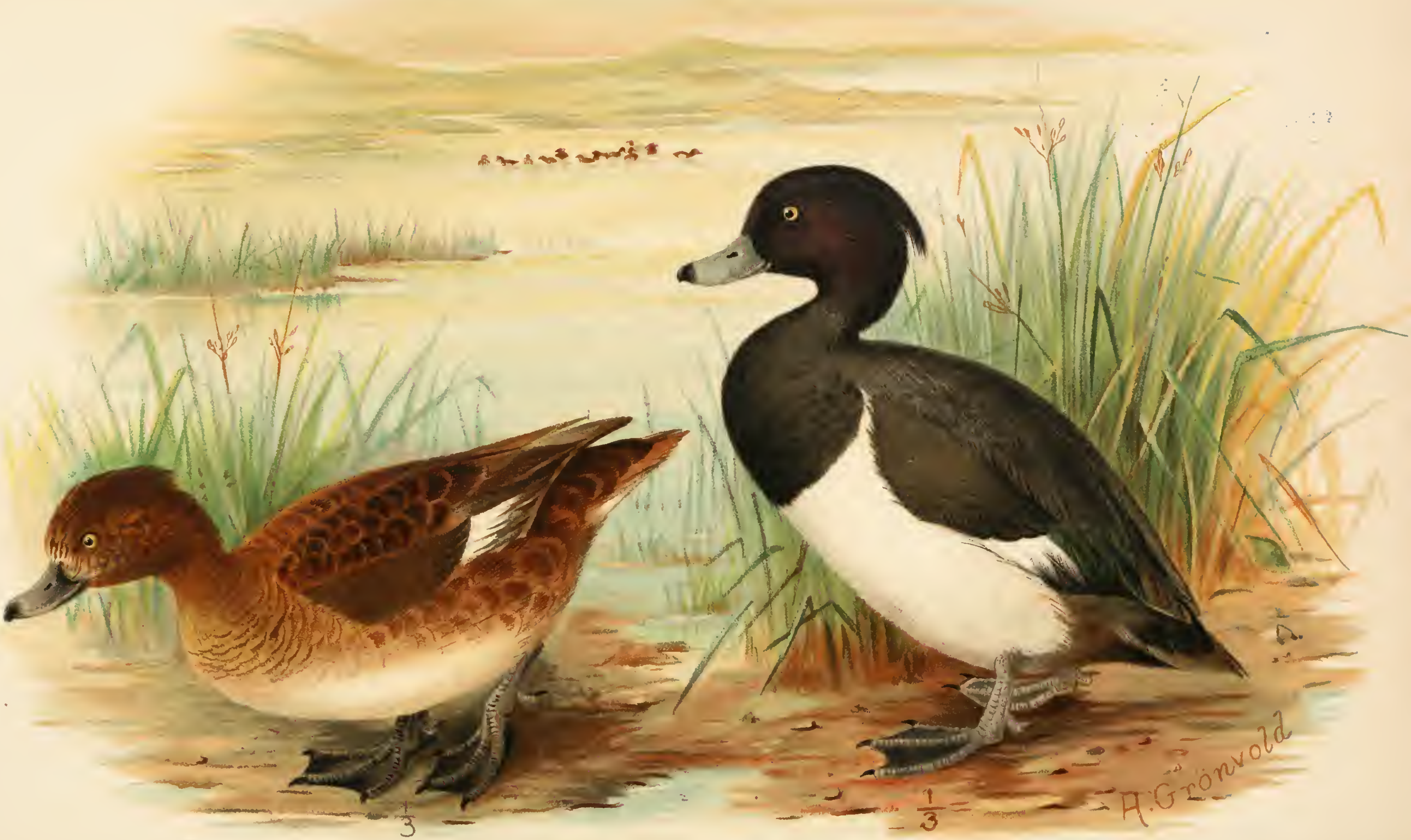
Memoirs of the Geological Survey of India, Ser. XV, Vol. IV, in exchange.

The Hope Reports, by E. B. Poulton, from the author.

Lepidoptera Indica, Vols. LXV, LXVI, from H. H. the Maharajah of Mysore.

PAPERS READ.

1. The present position of Economic Entomology in India, by H. Maxwell Lefroy, M.A., F.E.S., F.Z.S., Entomologist to the Government of India (read by the author).
2. Cannibalism in Snakes, by Captain F. Wall, I.M.S.
3. Oceanic or Andaman Teal, by Commander N. F. Wilson, R.I.M.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Fuligula fuligula.

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Natural History Society.

Vol. XV. BOMBAY. No. 4.

NOTES ON THE FLORA OF NORTHERN GANJAM.

By Cecil E. C. Fischer, I.F.S.

(Read before the Bombay Natural History Society on 16th June 1904.)

The Ganjam district is the northernmost of the Madras Presidency and borders on Bengal and the Central Provinces.

In some points the Flora of the district differs from that of any other part of the presidency and is characterised by the presence of *Shorea robusta*, which tree occurs nowhere else in Madras, excepting the Agency tracts of the Vizagapatam district (Jeypore estate).

The Ganjam district itself is, however, open to sub-division as regards its Flora, more especially from the fact of its bordering on the Bay of Bengal. As I have not had the privilege of visiting the Agency tracts of Ganjam, and have very slight acquaintance with the portion lying south of Ichchapur along the coast, these notes refer only to the 2 northern taluqs of the plains—the Berhampur taluq near the coast and the Gumsur taluq from 30 to 70 miles from the sea. The elevation of this tract is from 0 to 3,000 feet.

The list is obviously very far from complete, and the total absence of species from several large families, *e. g.*, Compositæ and Umbelliferæ, is striking; it must not be thought that this means that these orders are not represented, but simply that the classification of these orders being difficult they have been reserved for study after greater experience. I trust that this personal note, which seems necessary to prevent misapprehension, will be excused.

SOME PLANTS FROM NORTHERN GANJAM.

Dilleniaceæ.

1. Dillenia pentagyna, *Roxb.* *Uriya Raï.* Leafless when flowering in March. Fruiting and in full foliage in May.

Magnoliaceæ.

2. Michelia champaca, *L.* *Uriya Chompa.* Planted here and there.

Anonaceæ.

3. Artobotrys odoratissimus, *H. f. & T.* *Uriya Monaschompa.* In hedges.
4. Unona discolor, *Vahl.* One small tree planted at Chatrapur.
5. Polyalthia longifolia, *Benth. & H. f.* *Uriya Asuada.* Extensively planted as an ornamental tree.
6. Polyalthia cerasoides, *Benth. & H. f.* *Nobunisero.* Fruit in May and June.
7. Polyalthia korinti, *Benth. & H. f.* Somewhat scarce.
8. Polyalthia suberosa, *Benth. & H. f.* *Uriya Kuradia.*
9. Anona squamosa, *Linn.* *Uriya Sitaphòllo.* Run wild.
10. Anona reticulata, *Linn.* *Uriya Ramphollo.* Run wild.
11. Miliusa velutina, *H. f. & T.* *Uriya Gondopolaso.* Flowering in March.
12. Saccopetalum tomentosum. *H. f. & T.* *Uriya Gondopolaso.* Flowers in March.

Nymphæaceæ.

13. Nymphœa lotus, *Linn.* *Uriya Rongo Konï*
14. Nymphœa stellata, *Willd.*
15. Nelumbium speciosum, *Willd.*

In most tanks throughout the district.

Papaveraceæ.

16. Argemone mexicana, *L.* *Uriya Jogoda.* Very common on waste lands. Its yellow flowers appear from January to April.

Capparideæ.

17. Cleome monophylla, *Linn.* *Uriya Onosuriso.* Flowers in November and December.
18. Cleome viscosa, *Linn.* Flowering in August.
19. Gynandropsis pentaphylla. *DC. Prodr.* *Uriya Onosuriso.* In flower in November and December.
20. Cratæva religiosa, *Forst.* *Uriya Borono.* Planted ornamentally. Flowers appear usually when leaves have fallen, and presents a most handsome appearance with the 4 white petals and the numerous purple stamens. The globose red fruit are also pretty. The tree is quite bare and ugly, however, at least twice in the year.
21. Capparis sepiaria, *Linn.* *Uriya Hurippi.*
22. Capparis horrida, *Linn.* *Uriya Ashada.* In flower about January.

Violaceæ.

23. Ionidium suffruticosum, *Ging. in DC. Prodr.* *Uriya Bonomodurango.* This little herb flowers from July up to December ; the fruit is present at the same time.

Bixineæ.

24. Cochlospermum gossypium, *DC. Prodr. Uriya.* } *Bendia murdoni.*
Flowers appear in January and February. } *Popso koniari.*

25. Bixa Orellana, *Roxb. Uriya Jafra.* Planted here and there. Flowering October ; fruit ripe in November.

26. Flacourtia Ramontchi, *L'Herit. Uriya Boincho.* Flowers in March ; fruit in May.

27. Flacourtia sepiaria, *Roxb. Uriya Balliboincho.* In scrub forests near the coast.

Polygaleæ.

28. Polygala leptalea. *DC. Prodr.* The pretty little purplish flowers appear in October and November.

29. Polygala chinensis, *Linn.* Flowers from August to October.

30. Polygala telephioides, *Willd.* Flowering in January.

Portulaceæ.

31. Portulaca quadrifida, *Linn.* A small fleshy herb in wet places ; the diminutive yellow flowers bloom in November.

Guttifereæ.

32. Calophyllum inophyllum, *Linn. Uriya Polango.* Extensively planted.

Dipterocarpeæ.

33. Shorea robusta, *Gaertn. Uriya* { *Sodingi* / *Salua* } All over the Gumsur taluq. The chief forest tree reaching up to 3,000 feet. The flowers appear from the end of January till March, and the ripe winged fruit falls (sometimes germinating before falling) late in May or early in June.

Malvaceæ.

34. Sida carpinifolia, *L.* Flowers from September to December.

35. Sida rhombifolia, *Linn. Uriya Chinnapanra.* Flowers about November.

36. Sida cordifolia *L. Uriya Bissokopari.* Flowering about November.

37. Abutilon indicum. *G. Don.* Flowers appear in November.

38. Abutilon muticum. *G. Don.* In flower in January.

39. Urena lobata, *Linn.* } Flowering in November.
40. Urena sinuata, *Linn.* }

41. Pavonia zeylanica, *Cav.* In flower in January.

42. Pavonia odorata, *Willd.* Flowers in the rains.

43. Hibiscus micranthus, *Linn.* Flowers in January.

44. Thespesia lampas, *Dalz. & Gibs. Uriya Bono Koppa.* Flowers November.

45. Thespesia populnea, *Corr. Uriya Guia Usto.* Planted as an avenue tree.

46. Kydia calycina, *Roxb. Uriya Kopasia.* Flowers November.

47. Adansonia digitata, *L.* Three trees planted in a garden in Russellkonda. The fleshy white flowers appear in August and the fruit in September.

48. Bombax malabaricum, *DC. Prodr, Uriya:Bouro.* Common and attaining very large dimensions. Flowers January to March ; ripe pods March to May.

Sterculiaceæ.

49. Sterculia urens, *Roxb.* *Uriya Kodarlo.*
50. Sterculia villosa, *Roxb.*
51. Helecteres isora, *L.* *Uriya Muri-muri.* Very common undergrowth, especially on hill sides. Resembles *Grewia teliæfolia*, but the leaves are somewhat rough, and the pink or livid elongated irregular flowers and the spirally twisted fruit are very distinct.
52. Pterospermum acerifolium, *Willd.* *Uriya Bailo.* Flowering October and November; fruiting November and December.
53. Guazuma tomentosa, *Kunth.* *Uriya Devadaru.* Commonly planted in hedgerows.

Tiliaceæ.

54. Grewia tiliæfolia, *Vahl.* *Uriya Dhamono.* Flowers April and May; fruit May and June.
55. Grewia salvifolia, *Heyne.* *Uriya Kulo.*
56. Grewia pilosa, *Linn.* *Uriya Kulo.*
57. Grewia lævigata, *Vahl.*
58. Triumfetta rhomboidia, *Linn.* *Uriya Jatto-jatti.* Flowers from November to January.

Lineæ.

59. Hugonia Mystax, *Linn.* In coast scrub forests. Flowers July and August.

Malpighiaceæ.

60. Tristellateia australasica, *A. Rich.* A handsome climber with bright yellow petals and red anthers—a single specimen in a garden in Chatrapur. Flowers appear in August.
61. Hiptage madablota, *Gaertn.* *Uriya Madavi.*

Zygophylleæ.

62. Tribulus terrestris, *Linn.* Flowers and fruit in August.

Geraniaceæ.

63. Oxalis carniculata, *Linn.* *Uriya Bono-Sunnusunnia.* Flowers and fruit November and December.
64. Biophytum Reinwardtii, *Walp.* Flowering in rains and cold season.

Rutaceæ.

65. Toddalia aculeata, *Pers.* *Uriya Hau Mircho.* A common thorny scandent shrub with small white flowers, orange berries and 3-foliate spiny leaves. Flowers in November; fruit ripe in January.
66. Glycosmis pentaphylla, *Corr.* *Uriya Hau Mircho.*
67. Murraya Kœnigi, *Spreng.* *Uriya Mirsingipotaro.* The curry plant.
68. Limonia acidissima, *Linn.* *Uriya Bhenta.* Flowers March.
69. Atalantia monophylla, *Correa.* Flowers November.
70. Citrus medica, *Linn.* *Uriya Gojjonimbo.*
71. Citrus aurantium, *Linn.* *Uriya Narungo.*
72. Citrus decumana, *Linn.* *Uriya Pampalimas.*

These are cultivated and are found occasionally apparently wild, but really are the relics of deserted villages in forests.

73. Feronia elephantum, *Corr.* *Uriya Koito.* The woodapple. Flowers in January; ripe fruit in October.
74. Ægle marmelos, *Corr.* *Uriya Bello.*

Simarubeæ.

75. Ailantus excelsa, *Roxb.* *Uriya Gorimikarwati.* Flowers January; fruit March.

Ochnaceæ.

76. Ochna squarrosa, *Linn.* *Uriya Koniari.* Flowers in March.

Burseraceæ.

77. Bursera serrata, *Colebr.* *Uriya Sorupotri-Mohi.*
78. Garuga pinnata, *Roxb.* *Uriya Handala-Mohi.*

Meliaceæ.

79. Melia azadirachta, *Linn.* *Uriya Limbo.* Flowers March; fruit April and May.
80. Melia dubia, *Cav.* *Uriya Mahalimbo.* Ripe fruit in March.
81. Cipadessa fruticosa, *Blume.* *Uriya Ronabilli.*
82. Soymida febrifuga, *Adv. Juss.* *Uriya·Sohun.* Flowers February-March; fruit March-April.
83. Chloroxylon Swietenia, *DC. Prodr.* *Uriya Bheru.* Flowers March.
84. Swietenia macrophylla, *King.* A few young plants, planted in Chatrapur.

Olacineæ.

85. Olax scandens, *Roxb.* *Uriya Boderika.* Flowers March; fruit May.

Celastrineæ.

86. Celastrus paniculata, *Willd.* *Uriya Kattapengu.*

Rhamneæ.

87. Ventilago calyculata, *Tulasme.* *Uriya Pitchuli.* Flower November.
88. Zizyphus jujuba, *Lamk.* *Uriya Borokli.* Fruit January.
89. Zizyphus Œnoplea, *Mill. Gard.* *Uriya Kontekoli.* Flower October; fruit December.
90. Zizyplus xylopyrus, *Willd.* *Uriya Gotti.* Flower October; fruit December.
91. Zizyphus rugosa, *Lamk.* *Uriya Chunukoli.*

Ampelideæ.

92. Vitis quadrangularis, *Wall.*
93. Vitis gigantea, *Bedd.* *Uriya Tanqua.* A large creeper with furrowed corky bark; the stem contains a considerable quantity of water, which is quite sweet and potable.
94. Vitis latifolia, *Roxb.* *Uriya Dibiri.*
95. Vitis carnosa, *Wall.* } Fruiting in November.
96. Vitis pedata, *Vahl.* }

Sapindaceæ.

97. Cardiospermum Halicacabum, *Linn.* A graceful slender creeper with small white flowers, and triangular, inflated membranous capsule. Common in hedges and fields. Flowers August to December.
98. Allophylus Cobbe *var.* serratus, *Blume.* *Uriya Tsallunnia.*

99. Schleichera trijuga, *Willd.* *Uriya Kussumo.* Flowers March ; fruit May.

100. Sapindus trifoliatus, *Linn.* *Uriya Muktamunji.* Flowers December ; fruit March.

Anacardiaceæ.

101. Mangifera indica, *Linn.* *Uriya Ambo.* Grows to a very large size in the hills.

102. Anacardium occidentale, *Linn.* *Uriya Bhallia-ambo.*

103. Buchanania latifolia, *Roxb.* *Uriya Charo.* Flowers January and February ; fruit March.

104. Odina Wodier, *Roxb.* *Uriya Sorupotri Mohi.*

105. Semecarpus Anacardium, *Linn.* *Uriya Bhallia.* Fruit November.

106. Spondias mangifera, *Willd.* *Uriya Amboto.* Flowers March.

Moringeæ.

107. Moringa pterygosperma, *Gærtn.* *Uriya Munika.* Run wild in places.

Leguminoseæ.

108. Rothia trifoliata, *Pers.* Flowers November and December.

109. Crotolaria globosa, *W. & A.* Flowers December-January.

110. Crotolaria prostrata, *Roxb.* Flowering January and February.

111. Crotolaria evolvuloides, *Wight.*

112. Crotolaria rubiginosa *var.* Wightiana, *Willd.* *Uriya Bonojumka.* Flowers and pods October.

113. Crotolaria albida, *Heyne.*

114. Crotolaria linifolia, *Linn.*

115. Crotolaria calycina, *Schrank.*

116. Crotolaria sericea, *Retz.*

117. Crotolaria verrucosa, *Linn.* Flowers December.

118. Crotolaria clavata, *W. & A.* *Uriya Jummudu.* Flowering from July to January.

119. Crotolaria laburnifolia, *Linn.*

120. Indigofera echinata, *Willd.* Flowers and fruit January.

121. Indigofera glandulosa, *Willd.*
122. Indigofera linifolia, *Retz.*
123. Indigofera enneaphylla, *Linn.*
124. Indigofera pentaphylla, *Linn.*
125. Indigofera trifoliata, *Linn.*
126. Indigofera hirsuta, *Linn.*
127. Indigofera tinctoria, *Linn.*

Flowering October ; pods October and November.

128. Psoralia corylifolia. *Linn.* Flowers and pods December.

129. Millettia auriculata, *Baker.* *Uriya Rekorlo.*

130. Tephrosia purpurea and *var.* pumila, *Pers.* *Uriya Moïshia Koluthia.*

131. Tephrosia villosa, *Pers.* *Uriya Settokoluthia.*

132. Sesbania ægyptiaca, *Pers.* *Uriya Jointi.*

133. Sesbania aculeata, *Pers.*

134. Sesbania grandiflora, *Pers.*

135. Zornia diphylla, *Pers.* Flowers and pods, October to December.
136. Smithia sensitiva, *Ait.* Flowers November.
137. Æschynomene indica, *Linn. Uriya Sullo.* Flowers and pods January and February.
138. Æschynomene aspera, *Linn.* Uncommon. Flowers December.
139. Ormocarpum sennoides. *DC. Prodr.* Flowers and pods August. The muricated interrupted pods are very distinctive.
140. Leptodesmia congesta, *Benth.*
141. Pseudarthria viscida, *W. & A.*
142. Uraria picta, *Desv.*
143. Uraria hamosa, *Wall.*
144. Alysicarpus monilifer, *DC. Prodr.*
145. Alysicarpus vaginalis *var.* nummularifolia, *DC. Prodr.*
146. Alysicarpus rugosus *var.* styracifolius, *DC. Prodr.*
147. Ougeinia dalbergioides, *Benth. Uriya Bandhono.*
148. Desmodium pulchellum, *Benth. Uriya Kursunoponi.*
149. Desmodium latifolium, *DC. Prodr. Uriya Saloponi.*
150. Desmodium triflorum, *DC Prodr. Uriya Bhumikamarada.*
151. Abrus precatorius, *Linn. Uriya Koincho.*
152. Lathyrus sativus, *Linn.*
153. Mucuna pruriens, *DC. Prodr. Uriya Bhoincho.* Flowers November and December. The brown pods covered with irritating hairs ripen in January.
154. Erythrina indica, *Linn. Urya Paldua.* } Flowers February-March.
155. Erythrina suberosa. *Roxb. Uriya Chaldua.* }
156. Spatholobus Roxburghii, *Benth. Uriya Noi-polaso.*
157. Butea frondosa, *Roxb. Uriya Polasi-gocho.* Flowers March.
158. Butea superba, *Roxb. Uriya Polaso.*
159. Canavalia ensiformis, *DC. Prodr.* Flowering December and January.
160. Phaseolus trilobus, *Ait.*
161. Phaseolus aconitifolius, *Jacq.*
162. Phaseolus mungo, *Linn.*
163. Phaseolus trinervius, *Heyne.*
164. Vigna Catiang, *Endl. Uriya Borogudi.* Run wild here and there.
165. Clitoria Ternatea, *Linn.*
166. Pachyrhizus angulatus, *Rich. Uriya Rongojatto.* Run wild, and now abundant.
167. Dolichos Lablab, *Linn.*
168. Atylosia scarabeoides, *Benth. var.* nervosum, *Royle. Uriya Bonokoluthia.*
169. Cajanus indicus, *Spreng. Uriya Kandulo.* Occasionally run wild.
170. Dunbaria conspersa, *Benth. Uriya Opporjito.*
171. Rhynchosia suaveolens. } *DC. Prodr. Uriya Bonokandulo.* Flowers
172. Rhynchosia cana. } November.

173. Rhynchosia viscosa, *DC. Prodr.* Flowers December and January; pods ripen February.
174. Flemingia chappar, *Ham.* *Uriya Chinna.*
175. Flemingia conjesta, *Roxb.* Flowers December.
176. Dalbergia Sissoo, *Roxb.* Planted in avenues.
177. Dalbergia latifolia, *Roxb.* *Uriya Sissua.*
178. Dalbergia volubilis, *Roxb.* *Uriya Pitchuli.*
179. Dalbergia paniculata, *Roxb.* *Uriya Dhobi.* Fruit October.
180. Pterocarpus marsupium, *Roxb.* *Uriya Piasal.*
181. Pterocarpus santalinus, *Linn.* A few trees planted at Chatrapur.
182. Pongamia glabra, *Vent. Jard.* *Uriya Koronjo.* Flowers March; pods ripen January.
183. Derris scandens, *Benth.*
184. Cæsalpinia Bonducella, *Fleming.* The broad prickly pods ripen in January. The pods are two-seeded; the seeds are large and lead-coloured.
185. Cæsalpinia pulcherrima, *Swartz.* Planted ornamentally.
186. Cæsalpinia sepiaria, *Roxb.* *Uriya Gillo.*
187. Cæsalpinia coriaria, *Willd.* Planted.
188. Peltophorum ferrugineum, *Benth.* Planted in avenues.
189. Poinciana elata, *Linn.*
190. Poinciana regia, *Boja.*
191. Parkinsonia aculeata, *Linn.* *Uriya Suna Sullo.*
192. Cassia fistula, *Linn.* *Sunnari.* Flowering April, when it presents a very handsome appearance with its large thyrses of golden flowers. The pods are long and terete.
193. Cassia occidentalis, *Linn.* *Uriya Kasindra.* In Hooker's Flora this plant is shown as having 7 perfect stamens and the petals pale lilac. In Ganjam, however, where it is a most common weed, the perfect stamens are almost invariably 6 and the petals always yellow. The uppermost stamen as well as the 3 lowest is rudimentary. Flowers and pods August to January.
194. Cassia tora, *Linn.* *Uriya Tsakunda*
195. Cassia auriculata, *Linn.* In the southern part of the district only.
196. Cassia alata, *Linn.* One plant in a garden at Chatrapur.
197. Cassia siamea, *Linn.* *Uriya Sinia-Kasindra.* Introduced and planted as an avenue tree, and now run wild.
198. Cassia glauca, *Linn.* One specimen only found in a small remote village. No one knows how it came there, nor do there appear to be any other in the neighbourhood.
199. Cassia absus, *Linn.*
200. Cassia Kleinii, *W. & A.*
201. Cassia mimusoides, *Linn.*
202. Tamarindus indica, *Linn.* *Uriya* { *Koia.* *Tentuli.*

203. Bauhinia tomentosa, *Linn.* Flowers in August. Coast scrub land.
204. Bauhinia racemosa, *Linn.* *Uriya Ambata.* Flowers May.
205. Bauhinia Vahlii, *W. & A.* *Uriya Shiali.*
206. Bauhinia purpurea, *Linn.* *Uriya Borada.* Flowers October; pods January.
207. Neptunia oleracea, *Lour.* Flowering July.
208. Xylia dolabriformis, *Benth.* *Uriya* { *Malimo.* *Tangani.*
209. Entada scandens, *Benth.* *Uriya Giridi.* Rare; flowers in March.
210. Dichrostachys cinerea, *W. & A.* *Uriya Kuradia.* Common. Its red and white or yellow heads of flowers are striking.
211. Leucæna glauca, *Benth.* *Uriya Rossokodombo.* Frequent in and near villages, but apparently always planted.
212. Mimosa pudica, *Linn.* *Uriya* { *Thedasura-Bhai-bo.* *Nazukuri.* } The pretty little sensitive herb, with flowers in pink globose heads; the whole plant prickly. Flowers appear in the rains.
213. Mimosa rubicaulis, *Linn.* *Uriya Dontari.*
214. Acacia Farnesiana, *Willd.* Flowering January.
215. Acacia arabica, *Willd.* *Uriya Babulo.* Flowering in the rains; pods in April.
216. Acacia leucophlea *Willd.* *Uriya Guaria.* Flowers August; pods December.
217. Acacia sundra, *DC. Prodr.* *Uriya Khoiro.*
218. Acacia ferruginea, *DC. Prodr.* Planted, not indigenous.
219. Acacia intsia, *Willd.* *Uriya Dontari.*
220. Pithecolobium dulce, *Benth.* *Uriya Simakoia.* } Planted as ornamenta
221. Pithecolobium saman, *Benth.* } and avenue trees.
222. Hæmatoxylon campecheanum, *Linn.* Seeds from West Indies sown in 1899 have produced plants of 20 feet, which in the rains of 1903 bore fertile seeds.

Crassulaceæ.

223. Bryophyllum calycinum, *Salisb.* *Uriya Hemmokakari.*

Droseraceæ.

224. Drosera Burmanni, *Vahl.* } Flowers November and December. These
225. Drosera Indica, *Linn.* } small "insectivorous" plants resemble the European Drosera "Sundew".

Combretaceæ.

226. Terminalia catappa, *Linn.* *Uriya Badambo.* Planted.
227. Terminalia belerica, *Roxb.* *Uriya Bahada.* Flowers January-February.
228. Terminalia chebula, *Retz.* *Uriya Horada.* Flowers May; fruit December-February.
229. Terminalia Arjuna, *Bedd.* *Uriya Arjuno.* Flowers May; fruit November-December.

230. Terminalia tomentosa, *Bedd. Uriya Sahajo.* Flowers May; fruit November and December.

231. Calycopteris floribunda, *Lamk. Uriya Kokundia.*

232. Anogeissus latifolia, *Wall. Uriya Dhau.* Fruit January.

233. Anogeissus acuminata, *Wall. Uriya Pasi.*

234. Combretum decandrum, *Roxb. Uriya Korakokundia.* A tall creeper very conspicuous through the white floral leaves which appear in November and December. Flowers open out in January.

235. Combretum ovalifolium, *Roxb. Uriya Devakokundia.* Flowering March.

Myrtaceæ.

236. Psidium Guayava, *Linn. Uriya Bodajambo.*

237. Eugenia Jambos, *Linn. Uriya Gulabjambo.* Planted.

238. Eugenia operculata, *Roxb. Uriya* { *Monisia jambo.* / *Kuttini jambo.* } Not common.

239. Eugenia Jambolana, *Linn. Uriya Jambo.* Flowers March and April; fruit during rains.

240. Eugenia bracteata, *Roxb. Uriya Jatti.*

241. Barringtonia acutangula, *Gaertn. Uriya Hinjolo.* Flowering May and June.

242. Careya arborea, *Roxb. Uriya Kumbi.* Flowers March; fruit May.

243. Eucalyptus globulus, *Labill.* Planted and thriving well.

Melastomaceæ.

244. Sonerila tenera, *Royle.*

245. Memecylon edule, *Roxb. Uriya Niraso.*

Lythraceæ.

246. Woodfordia floribunda, *Salisb. Uriya Jatiko.* Flowers January-March.

247. Lawsonia alba, *Lamk. Uriya Manjati.* Planted.

248. Lagerstrœmia indica, *Linn.* Planted in gardens. Flowering in the rains.

249. Lagerstrœmia parviflora, *Roxb. Uriya Sidda.* Flowers May; fruit December.

250. Lagerstrœmia Flos Reginæ, *Retz.* A few planted specimens. Flowering during the rains.

Onagraceæ.

251. Jussiœa suffruticosa, *Linn.* Flowering December.

252. Ludwigia parviflora, *Roxb. Uriya Jholo-jholi.* Flowers in the rains.

Samydaceæ.

253. Casearia tomentosa, *Roxb. Uriya Giridi.* Flowers January; fruit March.

Passifloreæ.

254. Passiflora fœtida. A slender climber covered with glandular hairs. The pure white flowers appear in abundance in the rains; the globose green fruit is surrounded by the 3 glandular pubescent pinnatisect bracts which form an epicalyx.

Cucurbitaceæ.

255. Trichosanthes cucumerina, *Linn.* Flowering in the rains.
256. Luffa ægyptiaca, *Mill.*
257. Citrullus colocynthis, *Schrad.*
258. Cucurbita pepo, *DC. Prodr.* Cultivated and run wild.
259. Cephalandra indica, *Naud. Uriya Bodaka.*

Cacteæ.

260. Opuntia Dillenii, *Haw.* The prickly pear. Not extensive, pandanus being preferred locally for hedges.

Araliaceæ.

261. Heptapleurum venusolum, *Seem. Uriya Sukkulamadavi.*

Cornaceæ.

262. Alangium Lamarckii, *Thwaites. Uriya Ankulo.* Flowers March ; fruit May.

Rubiaceæ.

263. Anthocephalus Cadamba, *Miq. Uriya Kodomo.* More or less a sacred tree and frequently planted in villages. Though fairly common it is never found far from villages and is probably never truly wild. Attains a large size. Flowering November.
264. Adina cordifolia, *Hook. f. Uriya Holondo.* Flowers December.
265. Stephegyne parvifolia, *Korth. Uriya Mundi-mundi.*
266. Hymenodictyon excelsum, *Wall. Uriya Bodoka.*
267. Wendlandia tinctoria, *DC. Prodr. Uriya Tilei.* Flowers February.
268. Oldenlandia corymbosa, *Linn.*
269. Oldenlandia paniculata, *Linn.*
270. Oldenlandia alata, *Koen.*
271. Webera corymbosa, *Willd. Uriya Dhalakai.*
272. Randia uliginosa, *DC. Prodr. Uriya Pendrua.* Flowers May ; fruit December.
273. Randia dumetorum, *Lamk. Uriya Potua.* Flowers May ; fruit December.
274. Gardenia gummifera, *Linn. Uriya Burudu.* Flowers in March.
275. Gardenia latifolia, *Ait. Uriya Jantia.* Flowers March ; fruit December
276. Gardenia turgida, *Roxb. Uriya Bamunia.* Flowers in March.
277. Canthium didynum, *Roxb. Uriya Dhalasinga.* Flowers February.
278. Canthium parviflorum, *Lamk. Uriya Tuthuddi.*
279. Ixora parviflora, *Vahl. Uriya Kilakeruain.* Flowering January ; fruit in March.
280. Ixora coccinea, *Linn. Uriya Romonipulo.* Planted in gardens, not wild.
281. Pavetta indica, *Linn.* } *Uriya Katapengu.* Flowering May.
282. Pavetta tomentosa, *Roxb.* }
283. Morinda citrifolia *var.* bracteata, *Linn. Uriya Atsu.* Flowers April and May.
284. Hamiltonia suaveolens, *Roxb.*

285. Hydrophylax maritima, *Linn.* A small seashore sand herb.
286. Spermacoce stricta, *Linn.*
287. Spermacoce hispida, *Linn.* *Uriya Solugantia.*

Campanulaceæ.

288. Lobelia trigona, *Roxb.* Flowers November and December.

Plumbagineæ.

289. Plumbago zeylanica, *Linn.* *Uriya Chittapara.* Flowering January.
290. Plumbago rosea, *Linn.* Occasionally as an escape, rare.

Myrsineæ.

291. Ardisia humilis, *Vahl.* Common along hill streams, rare in the plains. Flowers in May.

Sapotaceæ.

292. Bassia latifolia, *Roxb.* *Uriya Mohulo.* Flowers January to March; fruit March and April.
293. Mimusops elengi, *Linn.* *Uriya Buralo.* Planted ornamentally and for the sake of the scented flowers—not wild.
294. Mimusops hexandra, *Roxb.* *Uriya Khiri.*
295. Achras sapota, *Linn.* A few plants from seed at Chatrapur, where they do not seem very happy.

Ebenaceæ.

296. Diospyros montana, *Roxb.* *Uriya Kossekoli.*
297. Diospyros embryopteris, *Pers.* *Uriya Dussarakendu.*
298. Diospyros sylvatica, *Roxb.* *Uriya Kaluchia.*
299. Diospyros chloroxylon, *Roxb.* *Uriya Kosse.* In scrub forests near the coast.
300. Diospyros melanoxylon, *Roxb.* *Uriya Kendu.*

Oleaceæ.

301. Jasminum auriculatum, *Vahll.* Flowering in August.
302. Neytanthes arbor-tristis, *Linn.* *Uriya* { *Godokodika.* *Gongo Simuli.* } Flowers September; fruit December.
303. Schrebera swietenioides, *Roxb.* *Uriya Juntia.*

Apocynaceæ.

304. Allamanda cathartica, *Kurz.* Introduced and run wild.
305. Carissa Carandas, *Linn.* }
306. Carissa spinarum, *DC Prodr.* } *Uriya Korondo.*
307. Vinca rosea, *Linn.* Commonly grown near temples and shrines.
308. Plumeria acutifolia. *Poiret* *Uriya* { *Torato.* *Gulichi.* } Generally cultivated and grown near temples, but frequently found run wild.
309. Thevetia neriifolia, *Juss.* *Uriya Holidia Konnari.* Grown near shrines and run wild.
310. Alstonia scholaris, *Brown.* *Uriya Chhatiana.* Rather uncommon, occurring generally in the neighbourhood of the hills.
311. Holarrhena antidysenterica, *Wall.* *Uriya Polarokeruain.*

312. Wrightia tinctoria, *Brown. Uriya Dudakeruain.* Frequently mistaken for holarrhena, but the corolla has a fimbriate corona and the follicles adhere at the tips.

313. Wrightia tomentosa, *Roen. Uriya Dukukeruain.* Differs from *W. tinctoria* in the fruit; the follicles being stouter and connate throughout.

314. Nerium odorum, *Soland. Uriya Konnari.* Planted only.

315. Chonemorpha Griffithi, *Hook.f.* One specimen of this handsome climber in a garden at Chatrapur.

316. Aganosma caryophyllata, *G. Don. Uriya Maliti.* Flowering during rains.

317. Ichnocarpus frutescens, *Br. Uriya Kaiua-noi.* Flowers in December.

Asclepiadeæ.

318. Hemidesmus indicus, *Br. Uriya Sugondi.*

319. Oxystelma esculentum, *Br.* Flowers December.

320. Calotropis gigantea. }
321. Calotropis procera. } *Br. Uriya Uruko.*

322. Dœmia extensa, *Br. Uriya Utturuli.* Flowers November; the follicles covered with soft long spines appear in December.

323. Ceropegia tuberosa, *Roxb.* Flowers August.

324. Ceropegia hirsuta, *Wight & Arn.* Flowers October.

325. Caralluma adscendens, *Br.* }
326. Boucerosia crenulata, *Wight & Arn.* } *Uriya Bhumi-kobara.* Flowering in the rains.

Loganaceæ.

327. Mitrasacme alsinoides, *Br.* Flowering January.

328. Strychnos nux-vomica, *Linn. Uriya Kora.* Flowers March; the red fruit ripen about December. Monkeys and birds eat the pulp, which appears not to be poisonous.

329. Strychnos potatorum, *Linn. Uriya Kotako.* Flowers March; fruit May and June.

Gentianaceæ.

330. Exacum pedunculatum, *Linn.* Flowers December.

331. Canscora diffusa. *Br. Uriya Burruburria.* Found chiefly on rocky hillsides. Flowering in January.

332. Canscora decussata, *Roem & Sch.* Flowers November to January.

333. Limnanthemum cristatum, *Grieseb.*

334. Limnanthemum indicum, *Thwaites.*

Hydrophyllaceæ.

335. Hydrolea zeylanica, *Vahl. Uriya Balluballua-kasindri.*

Boragineæ.

336. Cordia myxa, *Linn. Uriya Ambota.*

337. Cordia Macleodii, *H.f. & T. Uriya Boralo.*

338. Ehretia lævis, *Roxb. Uriya Guachipo.*

339. Ehretia buxifolia, *Roxb. Uriya Kujjipano.*

340. Trichodesma indicum, *Br. Uriya Raktokai.* Flowers December and January.

341. Cynoglossum sp. (denticulatum?), *Forsk.*

Convolvulaceæ.

342. Erycibe paniculata, *Roxb.*

343. Argyreia tiliæfolia, *Wight.* Probably not truly wild.

344. Argyreia speciosa, *Sweet.* Flowering September and October.

345. Ipomea bona-nox, *Linn.* Occasionally as an escape from gardens.

346. Ipomea coccinea, *Linn.* *Uriya Panikoda.* Flowers December.

347. Ipomea quamoclit, *Linn.*

348. Ipomea digitata, *Linn.* Flowers January.

349. Ipomea pentaphylla, *Jacq.*

350. Ipomea pes-tigridis, *Linn.* *Uriya Billenandi.* A pretty slender, softly hairy creeper, with white flowers and palmatisect leaves, somewhat recalling a tiger's " pug. " Flowering in the rains.

351. Ipomea tridentata, *Roth.*

352. Ipomea reniformis, *Chois.*

353. Ipomea obscura, *Ker.*

354. Ipomea sepiaria, *Koen.* Flowers January.

355. Ipomea beladambœ, *Roem & Sch.* Flowers January.

356. Ipomea aquatica, *Forsk.* In and around tanks and ditches. Flowers December and January.

357. Ipomea biloba, *Forsk.* *Uriya Notiali-noi.* Trailing across sand. Flowers large purple, leaves resembling those of the Bauhinias. Flowering in March.

358. Evolvulus alsinoides, *Linn.* *Uriya Vishnukrantha.* A slender small trailing herb with small blue flowers. Appears to flower sporadically throughout the year. A decoction is used medicinally as a febrifuge.

Solanaceæ.

359. Solanum nigrum, *Linn.* Flowers during the rainy season.

360. Solanum indicum, *Linn.* *Uriya Bejji.*

361. Solanum xanthocarpum, *Linn.*

362. Solanum trilobatum.

363. Physalis minima. Flowers August.

364. Datura fastuosa, *Linn.*

Scrophularineæ.

365. Sutera glandulosa, *Roth.* Flowers December to February.

366. Stemodia viscosa, *Roxb.* Flowering January and February.

367. Limnophila laxa, *Benth.* In flower in August and September.

368. Bonnaya brachiata, *Link & Otto.* Flowers February.

369. Scoparia dulcis, *Linn.* Flowering January. Sir Joseph Hooker (Flora B. I.) states that this plant was unknown in Roxburgh's time, and has probably spread from Serampore since 1845.

Orobanchaceæ.

370. Æginetia indica, *Roxb.*

Lentibularieæ.

371. Utricularia stellaris, *Linn.* } Flowering October to January.
372. Utricularia flexuosa, *Vahl.* }

373. Utricularia affinis, *Wight.* } Flowers in January.
374. Utricularia racemosa, *Wall.* }

Bignoniaceæ.

375. Millingtonia hortensis, *Linn. Uriya Simaronabilli.* Much planted.

376. Oroxylum indicum, *Vent. Uriya Pomponia.* Flowers September; fruit November and December. The flower is large, purple, fleshy; the capsules attain sometimes 3 feet in length and are broad and flat. The discoid seeds have large scarious or hyaline wings and are beautifully packed in the two valves so as to take up a minimum of space. The leaves fall before the capsules ripen.

377. Stereospermum chelenoides, *DC. Prodr. Uriya Patuli.* Flowers April.

378. Stereospermum suaveolens, *DC. Prodr. Uriya Patuli.*

379. Bignonia venusta, *Ker.* The fine orange flowers appear in January.

380. Tecoma stans, *Juss.* A few specimens in gardens. Flowers December.

381. Kigelia pinnata, *DC. Prodr.* Much planted as an avenue tree. The flowers resemble those of *Oroxylum indicum.*

Pedalineæ.

382. Pedalium murex, *Linn.* Flowering August and September.

383. Sesamum indicum, *D.C. Prodr. Uriya Rassi.* Occasionally as an escape from cultivation.

384. Martynia diandra, *Glox. Uriya Bhago-nakka.* Introduced into India from America and now widely spread. Very viscous all over. Leaves are large and palmate. Flowers purplish. Fruit, a capsule with 2 strong curved terminal spines and 2 or 3 ascending small straight ones below. This arrangement enables the capsule to fasten on to the fur of animals, and to this the rapid and widespread dispersal of the plant is no doubt due. The Uriya name, which means " tiger's claws, " explains itself.

Acanthaceæ.

385. Thunbergia fragrans, *Roxb. var.* vestita, *Nees.* A pretty slender creeper with white flowers, at first sight resembling a convolvulus. Flowering in the cold season.

386. Ebermaiera glauca, *Nees.* Flowering January.

387. Cardanthera uliginosa, *Ham.* Flowering January.

388. Hygrophila spinosa, *T. Anders. Uriya Roinakka.* Flowering from November to February along ditches and paddy fields. The corolla is usually pale purple, but white flowers are fairly common.

389. Petalidium barlerioides, *Nees. Uriya Udrakoppa.*

390. Dædalacanthus purpurascens, *T. Anders.*

391. Dædalacanthus montanus, *T. Anders.*

392. Hemigraphis latebrosa, *Nees.* This plant is separated from *H. elegans* by the number of seeds which is said to be never less than 8-seeded, and *H. latebrosa* never more than 6, but local specimens have furnished capsules with 6, 7 and 8 seeds; the two are possibly not even well-defined varieties. Grows mainly on rocky hillsides under shade. Flowers from December to February.

393. Blepharis boerhaaviœfolia, *Pers.* Flowering November.
394. Blepharis molluginifolia, *Pers.* Flowers December and January.
395. Burleria prionitis, *Linn.* *Uriya Dussakaranta.* Flowers December.
396. Burleria cristata, *Linn.*
397. Burleria strigosa, *Willd.*
398. Crossandra undulæfolia, *Salisb.* Doubtfully wild.
399. Andrographis paniculata, *Nees.*
400. Lepidagathis fasciculata, *Nees.*
401. Lepidagathis trinervis, *Nees.*
402. Justicia betonica, *Linn.* The white green-nerved bracts make the plant very conspicuous. Flowers December.
403. Justicia glauca, *Rottler.*
404. Justicia micrantha, *Wall.*
405. Justicia quinqueangularis, *Koen.*
406. Justicia procumbens, *Linn.*
407. Adhatoda vasica, *Nees.* *Uriya Bassungo.* Probably never wild, in the plains at least.
408. Ecolobium Linnæum, *Kurz.* Flowers in the rains.
409. Rungia parviflora *var*, pectinata, *Nees.*
410. Dicliptera parvibracteata, *Nees.*
411. Dicliptera micranthes, *Nees.*
412. Peristrophe bicalyculata, *Nees.* Flowering December and January.

Verbenaceæ.

413. Lantana crenulata, *Roxb.* } Mainly in gardens, occasionally as an
414. Lantana aculeata, *Linn.* } escape.
415. Stachytarpheta indica, *Vahl.*
416. Callicarpa arborea, *Roxb.* *Uriya.* { *Sanno-gumbari.* *Gondo-gumbari.* } Flowers May.
417. Tectona grandis, *Linn.* *Uriya.* { *Saguvani.* *Téko.* } Not indigenous. Planted and spreading from self-sown seed.
418. Premna tomentesa, *Willd.* *Uriya Subundi.*
419. Gmelina arborea, *Linn.* *Uriya Gumbari.*
420. Gmelina asiatica, *Linn.* Near the coast only.
421. Vitex negundo, *Linn.* *Uriya Begguna.*
422. Vitex pubescens, *Vahl.* Flowers November ; fruit ripen February.
423. Clerodendron serratum, *Spreng.* *Uriya Budagocha.*
424. Clerodendron infortunatum, *Wall.* *Uriya Bania.*
425. Clerodendron Siphonanthus. *Br.* A single specimen in a hedge at Chatrapur. No one knows how it came there, as it is not now to be found in any local garden.

Labiateæ.

426. Ocimum canum, *Sims.* *Uriya Gondotulasi.*
427. Ocimum basilicum, *Linn.*
428. Ocimum gratissimum, *Linn.*

429. Ocimum sanctum, *Linn.* *Uriya Dobbo-tutasi.*
430. Anisochilus carnosus, *Wall.* *Uriya Bennia.* Flowering November.
431. Hyptis suaveolens, *Poit.* Flowering January.
432. Anisomeles ovata, *Br.*
433. Leucas chinensis, *Br.*
434. Leucas suffruticosa, *Benth.*
435. Leucas cephalotes, *Spreng.*
436. Leucas aspera, *Spreng* *Uriya Gogoeshuo.*
437. Leonotis nepetæfolia, *Br.* A striking tall, straight annual, with conspicuous orange-red flowers, which appear in December.

Nyctagineæ.

438. Boerhaavia repens, *Linn.* *Uriya Attigapodi.*
439. Boerhaavia repanda, *Willd.* A graceful creeper with pretty pink trumpet-shaped perianth. Flowers in April.
440. Pisonia aculeata, *Linn.* *Uriya Hathi-ankuso.*

Amarantaceæ.

441. Celosia argentea, *Linn.*
442. Celosia cristata, *Linn.* Escaped from gardens.
443. Allmania nodiflora, *Br.* *var.* angustifolia and *var.* Roxburghii.
444. Digera arvensis, *Forsk.*
445. Amarantus spinosus, *Linn.* *Uriya Kontamalisho.*
446. Pupalia atropurpurea, *Maq.*
447. Nothærua brachiata, *Wight.* *Uriya Modurango.*
448. Aerua scandens, *Wall.*
449. Aerua lanata, *Juss.*
450. Achyranthes aspera, *Linn.* *Uriya Oppomaronqo.*

Polygonaceæ.

451. Polygonum tomentosum, *Willd.* *Uriya Panikoniari.* Flowers November.

Aristolochiaceæ.

452. Aristolochia indica, *Linn.* *Uriya Goppakanna.*

Loranthaceæ.

453. Loranthus longiflorus, *Desrouss.* *Uriya Modango.*

Santalaceæ.

454. Santalum album, *Linn.* Two trees planted at Russellkonda.

Euphorbiaceæ.

455. Euphorbia rosea, *Retz.*
456. Euphorbia thymifolia, *Burm.*
457. Euphorbia tirucalli, *Ham.* *Uriya Lorkasiddu.*
458. Euphorbia nivulia, *Linn.* *Uriya Kadisiddu.*
459. Bridelia retusa, *Spreng.* *Uriya Kosi.*
460. Cleistanthus collinus, *Benth.* *Uriya Korada.*
461. Phyllanthus reticulatus, *Poir.* *Uriya Jojangi.*
462. Phyllanthus emblica, *Linn.* *Uriya Aonla.*

463. Phyllanthus Niruri, *Linn.*

464. Phyllanthus distichus, *Muell.* Planted.

465. Antidesma ghesæmbilla, *Gaertn.* *Uriya Nuniari.*

466. Antidesma diandrum, *Roth.* *Uriya Nuniari.*

467. Jatropha glandulifera, *Roxb.* *Uriya Simanonkakhollo.*

468. Jatropha curcas, *Linn.* *Uriya Nonkakhallo.*

469. Trewia nudiflora, *Linn.*

470. Mallotus repandus, *Muell.* *Uriya Donkari.* Flowers November and December.

471. Mallotus philippinensis, *Muell.* *Uriya. Sudaragundi.* Flowers November.

472. Gelonium lanceolatum, *Willd.* *Uriya Kakara.*

473. Tragia involucrata, *Linn.* *Uriya Bichati.* A small creeper covered with irritating hairs. Flowers in September and October.

474. Pedilanthus tithymaloides. *Poit.* *Uriya* { *Shila siddu.* *Kola manika siddu.* } Introduced from the West Indies and now widespread; much used for hedges. The pink involucre has the appearance of an inverted slipper.

475. Manihot glazovii, *Muell.* Planted in Chatrapur and reproducing itself from seed.

Urticaceæ.

476. Holoptelia integrifolia, *Planch.* *Uriya* { *Dharango.* *Jirappa.* } Rather scarce.

477. Celtis tetranda, *Roxb.*

478. Streblus asper, *Lour.* *Uriya Shada.*

479. Ficus parasitica, *Koen.* *Uriya Korsano.*

480. Ficus bengalensis, *Linn.* *Uriya Bori.*

481. Ficus Benjamina, *Linn.*

482. Ficus elastica, *Roxb.* Introduced and grown from seed from Assam during the last 3 or 4 years.

483. Ficus religiosa, *Linn.* *Uriya Usto.*

484. Ficus Tsiela, *Roxb.* *Uriya Jori.*

485. Ficus hispida, *Linn.* *Uriya Bhaidimiri.*

486. Ficus Cunia, *Ham.*

487. Ficus glomerata, *Roxb.* *Uriya Dimiri.*

488. Artocarpus integrifolia, *Linn.* *Uriya Ponaso.*

489. Artocarpus Lakoocha, *Roxb.* *Uriya Joitio.* Very rare in the plains.

Casuarineæ.

490. Casuarina equisetifolia, *Forsk.* *Uriya Sabako.* Much planted along the coast, but does not reproduce itself naturally.

Salicineæ.

491. Salix tetrasperma, *Roxb.* *Uriya Panijambo.*

Cycadaceæ.

492. Cycas circinalis, *Linn.* *Uriya Oruguna.*

Orchideæ.

493. Habenaria susannæ, *Br.*

Scitamineæ.

494. Globba orixensis, *Roxb.*
495. Globba bulbifera, *Roxb.* } *Uriya Bono odda.* Flowers during rains.
496. Curcuma aromatica, *Salisb.* *Uriya Palu.*
497. Curcuma montana, *Roxb.* *Uriya Sakuta.* } Flowering during rains.
498. Zingiber ligulatum, *Roxb.*
499. Zingiber capitatum, *Roxb.* *Uriya Ghaigobara.*
500. Costus speciosus, *Smith.* *Uriya Ghaigobara.* Flowering during rains.
501. Canna indica, *Linn.* *Uriya Sorobojaia.* Found apparently wild.
502. Musa sapientum *var.* paradisiaca, *Linn.* *Uriya Kodali.* In the hills.

Amaryllideæ.

503. Agave americana, *Linn.*

Roxburghiaceæ.

504. Stemona tuberosa, *Lour.* A rather pretty twining plant, but the flowers have a fœtid smell resembling putrid flesh.

Liliaceæ.

505. Asparagus racemosus, *Willd.* { *Uriya Mahajolo.* *Uriya Chotabori.* } A slender graceful climber with sharp thorns.
506. Gloriosa superba, *Linn.* *Uriya Gongadoni.*

Commelinaceæ.

507. Commelina bengalensis, *Linn.*
508. Commelina obliqua, *Ham.*
509. Aneilema spiratum, *Br.*
510. Aneilema nudiflorum, *Br.*
511. Cyanotis axillaris, *Roem.*

Palmeæ.

512. Caryota urens, *Linn.* *Uriya Solopo.*
513. Phœnix sylvestris, *Roxb.* *Uriya Kojari.*
514. Phœnix acaulis, *Buch.* *Uriya Kojiri.*
515. Phœnix dactilifera, *Linn.* Planted in Chatrapur.
516. Calamus Rotang, *Linn.* *Uriya Betto.*
517. Borassus flabelliformis, *Linn.* *Uriya Talo.*
518. Cocos nucifera, *Linn.* *Uriya Nodia.*

Pandaneæ.

519. Pandanus fascicularis, *Lam.* *Uriya Khia.*

Aroideæ.

520. Colocasia antiquorum, *Schott.*

Alismaceæ.

521. Alisma reniforme, *Don.*

Naiadaceæ.

522. Aponogeton monostachyon, *Linn.*

Gramineæ.

523. Spinifex squarrosus, *Linn. Uriya Gudukanko.* A sea-shore sandbinding grass. The female spikelets are gathered in large globose heads with stelaltely spreading rachides, the heads become detached when the seeds ripen and are bowled along by winds, thus ensuring the spread of the plant.
524. Oriza sativa, *Linn.* Growing wild in marshy places.
525. Ischæmum angustifolium, *Hack. Uriya Babuli.*
526. Cynodon dactylon, *Pers. Uriya Dubbula-ghanso.*
527. Andropogon contortus, *Linn. Uriya Sinkulo-ghanso.*
528. Bambusa arundinacea, *Willd. Uriya Konta-bamso.*
529. Dendrocalamus strictus, *Nees. Uriya Salimbo-bamso.*

NEW SPECIES OF INDIAN *HYMENOPTERA*.

APIDÆ.

By Major C. G. Nurse, 113th Infantry.

(*Read before the Bombay Natural History Society*, 31*st March* 1904.)

In the following paper I have followed the generic nomenclature of Schmiedeknecht and Friese in their *Apidæ Europæ.* This in some instances differs from that adopted by Bingham in his Vol. I, Hymenoptera, of the Fauna of India Series. To follow the latter would doubtless have been more convenient for those who devote their attention to the Indian fauna only, but as the generic nomenclature of the former authors seems to be in accordance with the generally accepted rules, I thought it best to follow in their footsteps, more especially as this nomenclature seems to have been followed by most European Hymenopterists since the publication of their work.

My collecting during the past two summers has been entirely confined to the neighbourhood of Quetta and Peshin. As the fauna of Baluchistan is chiefly palearctic in character, and is closely allied to that of Central Asia and Eastern Europe, many of the species I obtained have been described by Morawitz, Fedtschenko and others. With a view to making the list of species which have occurred within British Indian limits as complete as possible, I have included below all the species which I have obtained which have not been previously recorded from India, whether entirely new species, or additions to the fauna of British India.

ANDRENA.

This genus is well represented in Baluchistan, and the majority of the species obtained appear to be new. In addition to those described below, I obtained, either from Kashmir or Baluchistan, the following European species :—

A. cineraria (Linn.) ; fairly common in Kashmir.

A. pilipes (Fabr.) ; very common at all elevations in Kashmir.

A. spinigera (Kirby) ; common at Quetta in the spring at fruit tree blossoms.

A. convexiuscula (Kirby) ; common both in Kashmir and Baluchistan.

A. tenuis (Mor.) ; Peshin ; apparently not common.

A. parvula (Kirby) ; common in Baluchistan in the spring.

Also specimens which I identify doubtfully as the following :—

A. nigriceps (Kirby) ; Baluchistan.

A. minutula (Kirby) ; Baluchistan.

(a) *Abdomen more or less red.*

ADRENA UNITA, n. sp.

♀ The pubescence, though somewhat sparse, hides the sculpturing of the head and thorax ; median segment very finely rugose, with no enclosed space ; abdomen minutely aciculate ; lamina at base of labrum short, transverse at apex ; second joint of antennæ longer than the two following united, vertex much narrowed and very convex ; median segment short, narrowed and rounded posteriorly ; abdomen as long as head and thorax united, narrowed at base and apex. Head and thorax black, apical two-thirds of flagellum red below ; legs black, the apical 3 or 4 joints of all the tarsi rufo-testaceous, calcaria pale testaceous ; abdomen pale red, shining, two very small lateral dark spots on 2nd segment, the first three segments almost entirely without pubescence ; pubescence, including scopa and anal fimbria, greyish white, the anal fimbria with a slightly pale fulvous tinge above ; wings clear hyaline, nervures and tegulæ pale testaceous.

Long. 8 mm.

Habitat—Peshin ; a single specimen.

This species may be at once distinguished by its abdomen being, with the exception of two small dark spots on the sides of 2nd segment, entirely pale red.

ANDRENA BALUCHA, n. sp.

♀ Head and mesonotum closely and finely, but somewhat shallowly, punctured, scutellum more sparsely, median segment very closely and finely, punctured, with a large triangular space at base somewhat coarsely rugose ; abdomen very finely, closely and shallowly punctured ; clypeus arched anteriorly, labrum at base with a small, bare, projecting lamina, narrowed towards apex, its anterior margin almost transverse. Black ; the 1st, 2nd, 3rd, and sometimes the lateral margins of the 4th abdominal segments, the anterior tibiæ below and at apex, the posterior tibiæ, calcaria, and all the tarsi pale red ; pubescence on head greyish and thick, on the thorax fulvous and short, but longer and finer, with a greyish tinge, on the sides of the median segment ; 1st abdominal segment with long, fine, greyish pubescence, and traces of a greyish apical band, 2nd to 4th segments with bands of greyish pubescence, anal fimbria with a golden tinge; pubescence on legs, and floccus greyish, inclining to fulvous or golden on the tibiæ and tarsi, especially on the inside of the latter; abdomen below almost bare, with some longish pubescence on the apical margins of segments; wings hyaline, very slightly and narrowly infuscated at apex; nervures and stigma testaceous, tegulæ dark testaceous; the 1st recurrent nervure is received into the 2nd cubital cell past its middle.

♂ Similar, slighter, the pubescence on clypeus and front usually with a fulvous tinge, antennæ with the 2nd and 3rd joints of the flagellum subequal; the basal abdominal segment is usually more or less black, and the amount of red on the 3rd segment varies considerably in different specimens; the infuscation of the wings at apex is less than in the ♀.

Long. ♀ 11—13 mm. ♂ 8—10 mm.

Habitat—Quetta; common, especially in lucerne fields.

Of the Indian species this is most nearly allied to *A. mollis*, but is larger and more pubescent. Of the European species it appears to be nearest to *A. alpina* (Mor.), but may be distinguished from that species by the 1st recurrent nervure being received distinctly beyond the middle of the 2nd cubital cell.

ANDRENA PESHINICA, n. sp.

♀ ♂ Head and thorax finely and closely, abdomen minutely and very closely, punctured; lamina at base of labrum short, broad, transverse at apex; the pubescence almost entirely hides the sculpturing of the head and thorax. Black; 1st and 2nd abdominal segments (sometimes only the base of the latter) both above and below dark red; claws and calcaria rufo-testaceous; pubescence thick and white, forming broad bands on abdominal segments 1—4, scopa and anal fimbria white, the pubescence on the tarsi slightly inclining to flavous in some lights; wings hyaline, their apices very lightly infuscated; nervures and tegulæ dark testaceous.

Long. ♀ 10—11 mm. ♂ 8—9 mm.

Habitat—Peshin; Quetta; fairly common.

Not very near to any other Indian species, but allied to *A. eversmanni* (Rad.). It differs in having the 1st and 2nd abdominal segments in both sexes red; the nervures also are dark testaceous, not black.

ANDRENA NIVEO-BARBATA, n. sp.

♂ Clypeus shallowly punctured, front above bases of antennæ very finely longitudinally striate, thorax opaque, apparently impunctate, minutely rugose, no enclosed space at base of median segment; abdomen impunctate, shining; head much wider than thorax, mandibles rather short, blunt at apex, with no visible tooth, 2nd joint of flagellum of antennæ longer than the next two united; median segment short, rounded posteriorly, abdomen shorter than the head and thorax united, very convex, the apical segment deeply incised. Black; clypeus bright yellow; apex of 1st, and the whole of 2nd, 3rd, and 4th segments dark red; apical 2 or 3 joints of the anterior tarsi, and the apical joint of the intermediate and posterior tarsi, rufo-testaceous, calcaria pale testaceous; anterior margin of clypeus with a long fringe of snow-white pubescence, remainder of pubescence griseous, except on the inside of posterior metatarsi, where it has a pale golden tinge; abdomen almost bare, except on the apical two segments; wings hyaline, nervures and tegulæ testaceous.

Long. 6 mm.

Habitat—Quetta; a single specimen taken at fruit tree blossoms in March.

Nearest to *A. cetti* (Schranck), but smaller, has no dark spots on clypeus, and wings are hyaline, not infuscated.

ANDRENA CARA, n. sp.

♀ Clypeus minutely and shallowly, but somewhat sparsely, punctured, mesonotum and scutellum shining and impunctate, median segment opaque, impunctate, without a basal area; abdomen minutely aciculate longer than the head and thorax united. Black; the apex of the 1st, the whole of the 2nd and 3rd, and sometimes the base of the 4th abdominal segments light red, both above and below; apical 3 or 4 joints of tarsi rufo-testaceous, calcaria pale; pubescence greyish white, long on head and thorax, and forming somewhat narrow apical bands on abdominal segments 2—4; scopa and anal fimbria greyish white; wings clear hyaline, nervures, tegulæ and stigma pale testaceous; stigma very large; the 1st recurrent nervure is received into the 2nd cubital cell just beyond the middle.

Long. 7—7·5 mm.

Habitat—Peshin; fairly common.

Nearest to *A. mollis*, but smaller, the legs black, not pale honey yellow.

ANDRENA HERA, n. sp.

♀ Head and thorax with the sculpturing almost hidden by the pubescence, through which the clypeus, vertex and mesonotum appear to be somewhat closely punctured; enclosed space at the base of median segment large, coarsely rugose; abdomen very minutely and closely punctured; lamina at base of labrum rather short, truncate at apex; 2nd joint of flagellum longer than the two following united; abdomen with the apical margins of segments 2—4 broadly depressed. Black; flagellum of antennæ rufo-testaceous; 1st and greater portion of 2nd abdominal segments pale red; apical 3 or 4 joints of all the tarsi rufo-testaceous, calcaria pale testaceous, those on the posterior tibiæ long and much curved; pubescence on vertex inclining to fulvous, on mesonotum, scutellum and postscutellum short, pale fulvous, on inside of tarsi pale fulvous-golden, anal fimbria black, with some fuscous or fuscous-white hairs laterally; remainder of pubescence, including scopa, greyish white, and forming broad bands on the apical depressed margins of segments 2—4, where it is short; wings clear hyaline, nervures and tegulæ testaceous.

Long. 10 mm.

Habitat—Quetta; a single specimen.

This species is allied to *A. peshinica* described above, but is larger, the anal fimbria is black, not white, and the wings are not infuscated at apex. It also appears to be near to *A. transitoria* (Mor.), but from this species it may be distinguished by the clear hyaline wings, as well as by the white pubescence on the front.

(*b*) *Abdomen reddish brown.*

ANDRENA FLAVO-FACIES, n. sp.

♀ Head and thorax with the sculpturing hidden for the most part by the pubescence, abdomen very minutely and closely punctured; head slightly broader than thorax, clypeus rounded anteriorly, the lamina at base of labrum short and inconspicuous, but somewhat broad; abdomen longer than head and thorax united. Head and thorax black, abdomen reddish brown; the mandibles at base, clypeus, and sides of front pale yellow; the labrum, mandibles in the middle, antennæ, and the basal and apical margins of segments 1—4 rufo-testaceous; the posterior tibiæ, all the tarsi, and the calcaria pale testaceous; pubescence greyish, on the mesonotum short with a greenish tinge, and forming apical bands on segments 2—4, with a trace of a band on apical margin of 1st segment; scopa and anal fimbria grey; wings hyaline, nervures and tegulæ testaceous.

♂ Only distinguishable from the same sex of *A. bi-emarginata*, described below, by the mandibles being yellow at base, and red in the middle, instead of wholly black.

Long. ♀ 7-8 mm. ♂ 6-7 mm.

Habitat—Quetta; Peshin; four specimens.

This species is, I believe, the only one hitherto described in which the ♀ has the clypeus and front yellow.

(*c*) *Abdomen entirely black.*

ANDRENA MARMORA, n. sp.

♀ Head and thorax very closely and finely punctured under the pubescence, which usually hides the sculpturing, triangular space at base of median segment finely rugose, abdomen minutely, closely, and shallowly punctured, except the apices of the segments, which are depressed and impunctate; eyes reaching the base of the mandibles, the latter dentate at apex, the tooth small. Black; the calcaria and claws rufo-testaceous; pubescence as follows: on head and thorax above greyish white, snow-white on front and sides of median segment, a black band across the thorax between the tegulæ; abdomen smooth and shining, without pubescence above, but with lateral spots of snow-white pubescence on segments 1—4, the spot on 1st segment small; 5th segment with long, silky white pubescence, below which the anal fimbria is black; head, thorax and abdomen below with black pubescence, except some greyish white hairs below the eyes, and sparse greyish apical bands on the apical one or two segments; legs with entirely black pubescence, except the femora of the anterior and intermediate legs, where it is long, silky and white; forewing with the basal half hyaline, apical half fuscescent, with some lighter patches; hindwing hyaline, its extreme apex infuscated; nervures and tegulæ blackish.

Long. 12-13 mm.

Habitat—Quetta; Peshin; not uncommon, but I did not secure a male.

This species seems to be nearest to *A. fusco-calcarata* (Mor.) from the Caucasus, of which only the ♂ is known. It differs, however, in several respects from the description of that species, of which I scarcely think it is the other sex.

ANDRENA DOLOROSA, n. sp.

♀ Head closely, but not very finely, mesonotum and scutellum sparsely, but deeply, punctured ; median segment with the sides very finely, the triangular space at base very coarsely, rugose ; abdomen almost impunctate, a few very fine and shallow punctures at the bases of segments ; mandibles dentate, the tooth small, lamina at base of labrum small, rounded at apex ; mesonotum with a conspicuous median longitudinal impressed line ; apical margins of abdominal segments 2—4 depressed. Black, the claws rufo-testaceous ; pubescence black, except on the front, where it is sparse and greyish, on the anterior tarsi, where it is greyish fuscous, on the scape below and on the posterior femora, where it is long and white ; abdomen shining, without pubescent bands, anal fimbria entirely black ; calcaria of posterior legs much curved ; wings fuscous, with a few somewhat lighter patches on the disc ; nervures and tegulæ black.

Long. 11-12 mm.

Habitat—Peshin ; two specimens.

This species belongs to the group of *A. pilipes* (Fabr.) but can be distinguished by its fuscous wings and almost entirely black pubescence.

ANDRENA COLLATA, n. sp.

♂ Finely, but somewhat shallowly and not very closely, punctured, including the abdomen ; head slightly wider than thorax, lamina at base of labrum small, emarginate at apex ; antennæ long, reaching nearly to the apex of thorax, 2nd joint of flagellum much shorter than 3rd ; an impressed line on mesonotum ; enclosed space at base of median segment large, triangular, finely rugose, but its margin not very clearly defined ; abdomen shorter than the head and thorax united, all the segments more or less constricted. Black ; the apical two or three tarsal joints more or less testaceous, calcaria pale ; pubescence grey, somewhat sparse and short, abdominal segments without pubescent bands, but more or less ciliated ; wings clear hyaline, tegulæ blackish, nervures and stigma very pale testaceous ; the 2nd cubital cell receives the 1st recurrent nervure distinctly past the middle.

Long. 5·5 mm.

Habitat—Quetta ; three specimens.

Nearest to *A. nana* (Kirby), but smaller, and may be distinguished by the nervures and stigma being very pale testaceous, and by the 2nd cubital cell receiving the 1st recurrent nervure past the middle.

ANDRENA LEGATA, n. sp.

♀ Very finely aciculate, the front, including the clypeus, very finely longitudinally striate; mesonotum with sparse shallow punctures, enclosed space at base of median segment large, triangular, depressed, finely rugose; lamina at base of labrum small, slightly incised at apex; median segment narrowed posteriorly; abdomen slightly shorter than head and thorax united, the 2nd, 3rd and 4th segments narrowly, but deeply, excavate at their bases. Black; somewhat opaque, except the abdomen, which is slightly shining; flagellum of antennæ towards apex below, and the whole of the tarsi rufo-testaceous, calcaria pale testaceous, apical margins of abdominal segments very slightly inclining to testaceous; pubescence sparse, greyish, inclining to flavous on clypeus, tarsi and anal fimbria; no pubescent bands on abdominal segments, which are scarsely even ciliated; wings fuscescent, stigma dark testaceous, nervures and tegulæ testaceous.

♂ Similar, clypeus yellow with two small dark spots; flagellum of antennæ piceous, 2nd and 3rd joints subequal; abdomen as long as head and thorax united, 2nd to 4th segments not or scarcely excavate at base, but their apical halves slightly depressed; wings almost clear hyaline.

Long. 6-7 mm.

Habitat—Peshin; four specimens.

Nearest to *A. tenuis* (Mor.), but slightly larger. The ♀ can be distinguished by the fuscescent wings, and by the 2nd to 4th segments being excavate at base; the ♂ by the 2nd joint of flagellum being about the same length as the 3rd, instead of equal to the 3rd and 4th united.

ANDRENA BI-EMARGINATA, n. sp.

♀ Sculpturing for the most part hidden by the pubescence, but where it can be distinguished closely and finely punctured; lamina at base of labrum bi-emarginate, almost tridentate, antennæ with the 2nd joint of the flagellum as long as the two following; space at base of medium segment almost smooth, opaque. Black; the flagellum below reddish, all the tarsi and sometimes part of the intermediate and posterior tibiæ more or less rufo-testaceous, calcaria pale testaceous; pubescence greyish, except on the vertex, pronotum, mesonotum, scutellum and postscutellum, where it is pale fulvous; scopa and anal fimbria grey; abdomen almost entirely covered by pubescence, which is thickest and forms somewhat broad bands on the apical margins of segments ; wings clear hyaline, tegulæ shining testaceous, nervures testaceous, stigma paler.

♂ Similar, smaller, apices of abdominal segments depressed ; the whole of the pubescence grey, but not so dense ; clypeus and a large spot on each side of it, reaching the inner orbits of the eyes, pale yellowish ; antennæ below paler red, tarsi pale testaceous ; the apices of the abdominal segments narrowly testaceous, but this is frequently not apparent owing to the pubescence.

Long. ♀ 7-8 mm. ♂ 6-7 mm.

Habitat—Peshin ; common in April.

I cannot find that the ♀ is very near to any other species. The ♂ is allied to *A. satellita,* described below, but may be distinguished from it by the flagellum being pale red below, not piceous. It may be distinguished from the same sex of *A. flavo-facies* by the mandibles being wholly black.

ANDRENA FLAGELLA, n. sp.

♀ Clypeus minutely aciculate, with a few very shallow punctures ; head and thorax minutely punctured, the enclosed space at base of median segment narrow, with fine lateral striæ at base ; abdomen minutely and closely punctured ; lamina at base of labrum broadly rounded at apex, a small tubercle near the base of mandibles ; antennæ with the scape very long and narrow, 2nd joint of flagellum as long as the three following, very narrow at base, gradually widening towards apex ; a carina from between bases of antennæ to anterior ocellus ; sides of front along inner orbits of eyes depressed, with fine depressed pubescence, this being particularly noticeable from above, vertex sharply narrowed above, and very convex ; abdomen scarcely as long as head and thorax united, its apical segment incised. Black ; the flagellum rufo-piceous, calcaria testaceous, claws rufescent ; pubescence greyish-white, clypeus in type specimen without pubescence, probably owing to abrasion, mesonotum with sparse pubescence ; on the sides of the median segment it is long, silky and snow-white ; on the apical margins of abdominal segments 1—4 it forms somewhat broad, uninterrupted, snow-white bands ; anal fimbria brownish on 5th, black on 6th, segment ; pubescence on legs and scopa short and greyish-white, except on the tarsi, where it has a pale golden tinge, especially on the inside ; wings hyaline, nervures and tegulæ testaceous.

Long. 9 mm.

Habitat—Quetta ; a single specimen.

Comes nearest to *A. opaca* (Mor.), but may easily be distinguished from it by the hyaline wings, and the long 2nd joint of flagellum of antennæ.

(d) *Abdomen black, the margins of the segments more or less testaceous.*

Andrena halictoides, n. sp.

♂ Slenderly built, minutely aciculate, front below antennæ very finely longitudinally striate, no enclosed space at base of median segment ; head nearly twice as wide as thorax, lamina at base of labrum hidden by the very long silky pubescence of the clypeus ; 2nd joint of flagellum of antennæ longer than, but not twice as long as, the 3rd joint ; cheeks strongly developed, with a large, bluntly pointed tubercle ; thorax short, median segment small and narrow ; abdomen long and slender, shaped like that of the same sex of *Halictus*. Black ; flagellum of antennæ rufo-piceous, the margins of the abdominal segments narrowly, and the apical 2 or 3 joints of the tarsi, testaceous, calcaria pale ; pubescence greyish white, very long, thick, and silky on clypeus and front, moderately long and thick on thorax and legs, sparse, with no bands, and very slight cilia on abdomen ; wings clear hyaline, tegulæ dark, nervures rather pale testaceous.

Long. 6-7 mm.

Habitat—Peshin ; seven specimens.

Easily distinguished from any species near it in size by the large tubercle on the cheeks. It has superficially the appearance of an *Halictus*, but the clypeus and face are not elongate, and the basal nervure is not sharply angled as in that genus.

Andrena satellita, n. sp.

♂ Head and thorax closely and finely punctured, but the sculpturing obscured by the pubescence ; the space at base of median segment ill-defined, minutely rugose ; abdomen minutely, but not very distinctly, punctured ; mandibles of moderate length, slender ; 2nd joint of flagellum of antennæ equal in length to the 3rd and 4th united, the 3rd joint nearly twice as broad as long ; median segment rounded and narrowed posteriorly ; abdomen very convex, shorter than the head and thorax united. Black ; the clypeus and a spot on each side of it, reaching the inner orbits of the eyes, pale yellow; antennæ piceous, sometimes rufo-piceous; apical margins of abdominal segments narrowly rufo-testaceous; apical two or three tarsal joints pale rufo-testaceous, calcaria pale whitish; pubescence grey, long on head and thorax, somewhat sparse on abdomen above, and forming sparsely ciliated apical bands, more or less interrupted, on segments 2—4; wings clear hyaline, tegulæ testaceous, nervures pale testaceous.

Long. 7-8 mm.

Habitat—Peshin; not uncommon.

This species is nearest to *A. erythrocnemis* (Mor.) from Russia, but may be distinguished from it by the posterior tibiæ and mandibles being entirely black.

MELANAPIS RUFIFRONS, n. sp.

♀ Head and mesonotum closely and finely, scutellum more sparsely, punctured, median segment finely rugose, with a triangular area at base less finely so; at the extreme base of this area there is a smaller depressed triangular space, produced into a median longitudinal furrow; abdomen microscopically aciculate, shining; clypeus roundly incised, a somewhat long, but not very broad, lamina at base of labrum very slightly incised at apex; front with a small carina between bases of antennæ; 2nd joint of flagellum longer than the two following united; an impressed longitudinal line on basal half of mesonotum, and two short impressed lines parallel with the tegulæ; abdomen as long as head and thorax united, the apices of the segments very slightly depressed. Dark red, the head less dark than the thorax and abdomen, which are more or less variegated with black; legs black, variegated with red, calcaria and apical two or three tarsal joints rufo-testaceous; pubescence on head and anterior tarsi rufous, on thorax, legs and abdomen black, sparse on the thorax, dense on the legs, abdomen bare except the anal fimbria; wings deep, shining fuscous, nervures piceous, tegulæ red.

♂ Similar, less stoutly built, head much wider than thorax, 2nd joint of flagellum about as long as the two following, pubescence on head darker rufous, head and thorax darker red, abdomen almost entirely black.

Long. ♀ 15-16 mm. ♂ 13-14 mm.

Habitat—Quetta; five specimens.

This genus was first described by Mr. Cameron from specimens obtained by me at Ferozepore, which he named *M. violaceipennis.* I have since obtained the same species both in Kashmir and Baluchistan. The present species is easily distinguished from *M. violaceipennis* by being chiefly red, not black. *Melanapis* is in many respects very close to *Andrena,* though at first sight it differs greatly from most species of that genus. In my opinion the two genera are barely separable.

NOMIA BAHADUR, n. sp.

♀ Clypeus finely longitudinally rugose, the sculpture of the remainder of head more or less hidden by the pubescence; mesonotum and scutellum closely and finely punctured, median segment finely rugose, with a very narrow space at its base longitudinally striate; abdomen almost impunctate, the 1st and 2nd segments only with a few shallow punctures; clypeus sub-porrect, transverse anteriorly, its margin upturned, and with a median longitudinal carina; mesonotum with three parallel impressed lines from the base, not reaching its apex, and two shorter impressed lines parallel with the tegulæ; scutellum large and prominent, more finely and closely punctured in the centre than towards the sides, its posterior lateral angles produced into blunt teeth; it is produced posteriorly into a kind of plate, which is concave above, its apex deeply triangularly incised, and thus resembling the scutellum of the genus *Crocisa*; median segment vertical, almost hidden by the scutellum; apical margins of abdominal segments depressed; calcaria of intermediate tibiæ with three or four spines on each side; outer calcar of posterior tibiæ long and upcurved, inner calcar pectinated. Black; flagellum of antennæ dark, rufous below; apical joints of tibiæ more or less rufo-testaceous; apical margins of abdominal segments 1—4 with pale blueish green interrupted non-pubescent bands, the interruptions becoming successively narrower on each segment towards apex; calcaria dark rufo-testaceous; pubescence on head and thorax greyish white, and sparse, longer on the sides of median segment; on the abdomen there is a little greyish pubescence on the lateral margins of segments; anal fimbria and pubescence on ventral segments dark fulvous, mixed with some fuscous hairs; pubescence on legs short, greyish outside, dark fulvous inside; wings hyaline at base, the apical half infuscated, nervures and tegulæ rufo-piceous; the 2nd cubital cell receives the 1st recurrent nervure near its outer angle.

♂ Sculpturing of head entirely hidden by the pubescence; mesonotum and scutellum closely and rugosely punctured; abdomen with the basal two segments more distinctly punctured at base than in the ♀; calcar of intermediate tibiæ short, not spined; posterior femora enormously incrassated, posterior tibiæ short, much widened at apex, and produced both above and below, their width at apex being nearly equal to their length. Black; antennæ piceous; apical plate of scutellum rufo-testaceous; abdomen with non-pubescent interrupted bands, similar to those of the ♀, on segments 1—5; pubescence on head and mesonotum thick, short and fulvous, on median segment and 1st abdominal segment griseous; a little more griseous or pale fulvous pubescence on the abdomen than in the ♀; anal fimbria black; pubescence on legs grey, very short, longer and pale golden on inside of posterior tarsi; wings light flavo-hyaline, their apices infuscated, nervures and tegulæ dark rufo-testaceous.

Long. 13—15 mm.

Habitat—Deesa; not uncommon, but very local.

This species would come into Bingham's key under a new sub-division of " A ", " all the fasciæ interrupted."

NOMIA KANGRÆ, n. sp.

♀ The pubescence hides the sculpturing on the clypeus and front, postscutellum, and sides of the median segment; vertex closely and deeply punctured, mesonotum and scutellum more finely and closely punctured, bases of abdominal segments very deeply and distinctly punctured, the punctures being fine and close at the bases, larger and less close in the middle of segments, apices of segments, under the pubescence, depressed and impunctate; pronotum with a notch in the centre anteriorly, enclosed space at base of median segment rather small, longitudinally striate or rugose. Black; 2nd and 3rd joints of flagellum of antennæ red below, all the tibiæ and tarsi more or less rufo-testaceous, apices of abdominal segments under the pubescence testaceous; pubescence pale golden, very dense on the clypeus and front, less dense on the thorax, and forming dense, moderately broad apical bands on the margins of segments 1—5; anal fimbria and pubescence on legs of the same colour as the rest of the pubescence; wings flavo hyaline, their apices infuscated, nervures and tegulæ pale rufo-testaceous, the 1st recurrent nervure is received into the 2nd cubital cell past its middle,

Long. 8 mm.

Habitat—Kangra Valley, 4,500ft.; two specimens received from Mr. G. C. Dudgeon.

Nearest to *N. aurifrons* (Smith) and *aurobalteata* (Cam.), from both of which it may be distinguished by the abdomen being punctured, except at the apices of the segments.

PASITES MACULATUS (Jur.).

I obtained at Quetta a specimen of this genus, which I identify with some doubt as this species.

EPEOLUS PICTUS (Nyl.).

One specimen of an *Epeolus*, which, I think, is this species, was obtained by me at Quetta.

AMMOBATES SOLITARIUS, n. sp.

♀ Head, including the labrum, and thorax very closely and finely, abdomen still more minutely, punctured, but the whole of the sculpturing more or less obscured by the pubescence; labrum very long, rounded at apex; maxillary palpi 6-jointed, the basal and apical joints the longest, sub-equal in length, the apical joint very narrow; antennæ reaching to the scutellum, which is prominent, almost bi-tuberculate, having a median depression; postscutellum semicircular, rather large; median segment almost vertical; abdomen nearly as long as the head and thorax united, apical segment minutely rugose, wide, almost truncate at apex. Head and thorax black; antennæ rufo-piceous; labrum, abdomen, the greater part of the femora and the whole of the tibiæ and tarsi rather light red, except the claws, which are long and blackish; pubescence grey, short, thick on head and thorax, and forming wide bands on apical margins of segments 1—5; wings hyaline, nervures piceous, tegulæ red.

♂ Similar, but abdomen and legs somewhat darker red, apical abdominal segment broadly incised.

Long. 6-7 mm.

Habitat—Quetta; two specimens of each sex.

This genus is new to India. The present species is nearest to *A. armeniacus* (Mor.), but may be distinguished by the clear hyaline wings, and by the first three abdominal segments being pubescent at apex, not smooth and bare.

CTENOAPIS LUTEA (Cam.).

In the Annals and Magazine of Natural History for August, 1901, Mr. Cameron described two species of a new genus from specimens obtained by me at Ferozepore. I had then only a few specimens, but the same insects are common at Quetta, and I find that they must be united as ♀ and ♂ of one species. I have seen them in coitu, and have obtained a considerable number of both forms; all those of the lutea form were females, and all those of the flavomaculata form were males. The ♂ is invariably the larger and more stoutly made insect. The maxillary palpi are 6-jointed, the basal joint the broadest, 2nd the longest, remainder sub-equal. The labial palpi are 4-jointed, the basal joint about one-third longer than the 2nd, apical two joints small, sub-equal. The antennæ of the ♀ are 12-jointed, those of the ♂ 13-jointed. The ♂ has only one calcar on the posterior tibiæ, the ♀ having two. In both sexes the tarsal claws have a large but blunt subapical tooth, and a somewhat large pulvillus.

NOMADA DETECTA, n. sp.

♀ Head and thorax finely rugose, granular, abdomen minutely aciculate; clypeus produced, its anterior margin rounded; a short carina between bases of antennæ; scutellum with a median depression, causing it to appear almost bi-tuberculate; postscutellum and median segment very steeply sloped, the enclosed space at the base of the latter almost smooth; 2nd abdominal segment the broadest. Dark red, the mandibles at base, the labrum, clypeus and front as high as the base of antennæ, scape of the latter, pronotum, tubercles and the greater part of the thorax laterally and below, scutellum, postscutellum, the median segment except in the centre, transverse bands on segments 1, 4 and 5, lateral spots on segments 2 and 3, and the tibiæ and tarsi more or less yellow; the amount of yellow, especially on the abdomen, varies greatly, and some specimens are almost entirely red; tarsi and apical abdominal segment with a little pale golden pubescence, remainder almost bare; wings hyaline, very slightly infuscated along their apical margins; nervures testaceous, tegulæ yellow.

♂ Sculpturing similar to that of the ♀, but the enclosed space at the base of median segment is finely rugose, not smooth; apical abdominal segment incised, 2nd joint of flagellum of antennæ distinctly longer than 3rd. Black; the mandibles, labrum, clypeus and front as high as the base of antennæ, scape of the latter, pronotum, tubercles and the greater part of the thorax laterally and below, scutellum, postscutellum, large round sublateral spots on median segment, wide bands on all the abdominal segments (those on segments 2 and 3 slightly interrupted), and the greater part of the legs bright yellow; flagellum of antennæ black above, ferruginous below; posterior femora black at base; clypeus and front with silvery, cheeks, thorax below, abdomen at apex, and legs with sparse greyish pubescence; wings hyaline, with slight indications of infuscation at apical margin, nervures testaceous, tegulæ yellow.

Long. 8-9 mm.

Habitat—Quetta; Peshin; fairly common.

NOMADA ANNEXA, n. sp.

♀ Head and thorax closely and deeply punctured, abdomen impunctate; clypeus sub-porrect, its apex almost transverse; a carina between bases of antennæ, 2nd and 3rd joints of flagellum subequal; scutellum bi-lobed, prominent; median segment with an enclosed triangular space finely rugose. Dark-red; the antennæ above, mesonotum and the greater part of the median segment black; abdomen lighter red, shining, with lateral yellow spots on 2nd and 3rd segments, the spots on the latter being very small, the segments at base inclining to black; scarcely any pubescence, except on the apical abdominal segment, where it is greyish fuscous; wings subhyaline, slightly infuscated at apex; tegulæ red, nervures piceous; only two cubital cells, the 2nd being formed from what is usually the 2nd and 3rd, though there is no sign of a transverse cubital nervure between them.

Long. 5 mm.

Habitat—Kashmir; two specimens obtained between 5,000 and 6,000 feet.

This species, which agrees in every other respect with the genus *Nomada*, can be easily recognised by having only two cubital cells. As I obtained two specimens exactly similar at the same place it can, I think, scarcely be considered an occasional "sport," though I believe that this genus has not previously been obtained with only two cubital cells.

I obtained at Quetta also the following species of *Nomada*, which have not previously been recorded from Indian limits:—

N. coxalis (Mor.).
N. distinguenda (Mor.).
N. furva (Panzer).
N. mutica (Mor.).

SYSTROPHA PLANIDENS (Giraud).

Three specimens ; Quetta.

OSMIA SPONSA, n. sp.

♀ Closely and finely punctured, median segment minutely rugose, with no enclosed space ; mandibles with two longitudinal carinæ, bidentate, the inner tooth broad, blunt, almost bifid ; clypeus with its anterior margin transverse ; 1st and 2nd joints of flagellum of antennæ subequal, 3rd and 4th also subequal, shorter than 1st and 2nd ; scutellum prominent, level with the mesonotum ; median segment short, rounded, almost vertical ; abdomen nearly cylindrical, convex, shorter than head and thorax united. Dark blue, abdomen brighter blue, shining ; clypeus blueish black, antennæ piceous, legs, including calcaria, black ; pubescence greyish white, somewhat sparse, forming entire narrow subapical bands on abdominal segments 1—5 ; scopa white ; pubescence on inside of posterior tarsi black ; wings hyaline, very slightly infuscated at apex, nervures and tegulæ piceous.

♂ Similar ; no pubescent bands on abdomen ; front with long greyish pubescence ; wings clear hyaline, very slightly infuscated in radial cell.

Long. ♀ 7-8 mm. ♂ 5·5 mm.

Habitat—Quetta ; not uncommon, but I only obtained one ♂, which may be an unusually small specimen.

Much smaller than *O. adæ*, which has no pubescent bands on the abdomen. Nearer to the European *O. gallarum* (Spin.), but clypeus not emarginate, abdominal fasciæ 1—3 not interrupted, and wings only slightly infuscated.

OSMIA BALUCHA, n. sp.

♀ Head and thorax closely and finely, abdomen more minutely, but very closely, punctured ; lower margin of eyes not reaching the base of the mandibles, and the portion of the face between them enlarged and subtuberculate on the outer side ; clypeus with a median longitudinal carina, its anterior margin produced, sub-porrect, deeply triangularly emarginate, leaving two triangular sub-porrect laminæ ; remainder of head, thorax and abdomen with the sculpturing to a considerable extent hidden by the pubescence. Aeneous green, the head and thorax somewhat darker than the abdomen ; all the calcaria, and sometimes the apical two or three joints of the tarsi, rufo-testaceous ; pubescence grey, mixed with a few black hairs ; abdomen with ciliated bands of fulvescent pubescence, along the apical margins of segments 1—5 ; pubescence on the inside of posterior tarsi and scopa fulvous ; wings hyaline, nervures black, tegulæ dark testaceous ; 2nd cubital cell considerably larger than the 1st.

♂ Similar, smaller ; clypeus transverse at apex, not porrect ; antennæ reaching beyond the scutellum ; apical abdominal segments not dentate.

Long. ♀ 12-13 mm. ♂ 8-10 mm.

Habitat—Quetta ; fairly common in March.

I bred both sexes from a mud nest similar to that made by *Eumenes*, which I procured from a rafter in the roof of a stable.

This species belongs to the subgenus *Ceratosmia* (Thoms.).

OSMIA SITA, n. sp.

♀ Head and thorax closely punctured, granular, abdomen shining, more finely punctured, the punctures being closest along the margins of the segments ; head large, the cheeks wider than the eyes ; mandibles large, tridentate ; clypeus rounded at apex, not serrate ; abdomen very convex, slightly longer than thorax. Black, the pubescence greyish white, moderately thick ; abdomen with lateral patches of white pubescence on apical margins of segments 1—5 ; scopa white, long and thick ; tarsal claws rufous, calcaria black ; pubescence on inside of posterior tarsi fuscous ; wings hyaline, the radial cell and outer margin fuscescent, nervures and tegulæ black.

♂ Smaller, pubescence longer and thicker, but the lateral marks on apical margins of abdominal segments less well defined ; segments 3—5 ciliated with greyish hairs ; apical abdominal segment serrate, emarginate at apex, with a blunt tooth on either side ; wings subhyaline.

Long. ♀ 10 mm. ♂ 8 mm.

Habitat—Quetta ; not uncommon in May.

Quite distinct from any other Indian species. Belongs to the subgenus *Acanthosmia* (Thoms.).

MEGACHILE.

I obtained in Baluchistan specimens of the following species of this genus :—

M. asiatica (Mor.) ; common.
M. apicalis (Spin.).
M. rotundata (Fabr.).
M. desertorum (Mor.) ; one specimen from Peshin.
M. muraria (Retz.) ; fairly common.

ANTHIDIUM SALTATOR (Nurse).

I should add to the description of the ♂, which I published in the Journal of the Asiatic Society of Bengal, Vol. LXX, Part II, p. 152, that the teeth on the apical segment are as follows: two lateral, short but fairly sharp, and two apical, which are very blunt, with a space between them equal to their width. The apical teeth project much beyond the lateral ones.

ANTHIDIUM FLORNTINUM (Fabr.) *var.* CAUCASICUM (Rad.).

This species or variety is common in the lucerne fields at Quetta.

A. FEDTSCHENKOI (Mor.).

Two specimens from Quetta.

CAMPTOPŒUM RUFIVENTRE (Mor.).

No species of this genus has hitherto been recorded from India. I obtained at Quetta some 20 specimens of both sexes of a bee of this genus; the ♂ agrees with the description of Morawitz's *C. rufiventre*, and the ♀ with that of his *C. schewyrewi*. All my specimens are undoubtedly one species, and thus the name of *rufiventre* must stand by the laws of priority. The specimens vary among themselves to some extent, especially as regards the amount of yellow on the thorax; the wings in the ♀ are darker than those of the ♂.

This species, having been described from Turkestan, and extending to Quetta, must be widely spread, but all the specimens which I obtained were caught at a particular kind of thistle in an area of about 100 square yards. I never came across either the bee or the thistle elsewhere. I mention this to show how easily a species, which frequents a special flower, may be overlooked, though spread over a large area.

CERATINA INO, n. sp.

♀ Head, thorax and abdomen minutely aciculate, enclosed space at base of median segment finely rugose. Head and thorax dark metallic greenish black; mandibles, clypeus, a spot above it, the antennæ below, pronotum, scutellum, postscutellum, and the legs pale yellowish testaceous; antennæ above rufo-testaceous; abdomen pale yellow or pale testaceous, 1st (sometimes also 2nd and 3rd) abdominal segment with a narrow transverse subapical band black; pubescence greyish white, wings hyaline and iridescent, nervures very pale testaceous, tegulæ yellowish.

♂ Similar, more slender.

Long. 3 mm.

Habitat—Quetta ; Peshin ; common at tamarisk flowers.

Easily distinguished from any other species by the abdomen being almost entirely pale yellow or testaceous yellow.

CERATINA EGERIA, n. sp.

♀ Smooth and shining, the median segment finely rugose at base. Head and thorax black, with a greenish or blueish tinge, abdomen brownish black; the apex of the anterior femora, the anterior tibiæ and tarsi, the intermediate tibiæ and the tarsi at base, the posterior tibiæ below and the tarsi pale yellow ; antennæ rufo-testaceous, lighter below, abdomen with a pale yellowish white transverse band at base of 2nd segment ; all the segments very narrowly testaceous at apex, abdomen below more or less testaceous ; wings clear hyaline and iridescent, nervures and tegulæ very pale testaceous, scarcely visible without a microscope.

♂ Similar, the clypeus pale yellowish white, the antennæ below, the apex of the femora, and the whole of the tibiæ and tarsi pale yellow ; the band at base of 2nd abdominal segment frequently obsolete.

Long. 3 mm.

Habitat—Quetta ; common at tamarisk flowers.

Nearest to *C. parvula* (Smith) from Albania, but may be distinguished by the abdomen not being punctured.

CERATINA CORINNA, n. sp.

♀ Clypeus sparsely and shallowly, head closely and somewhat coarsely, thorax more finely and less closely, abdomen closely and somewhat coarsely, punctured, the apical margins of the segments constricted and more finely punctured ; clypeus with the anterior margin transverse in the centre, rounded at the sides ; scutellum with its lateral margin compressed ; abdomen much longer than head and thorax united, the apical segment with a slight keel in the middle at apex ; all the ventral abdominal segments smooth at base, punctured in the middle and at apex, the punctures gradually increasing in size towards apex, 3rd segment with a transverse median furrow. Bronzy green, the clypeus and tubercles pale orange-yellow ; antennæ black or blackish ; labrum, a spot on each side of front near apex of clypeus, and the furrow on 3rd ventral segment black ; a line on the anterior tibiæ, the intermediate tibiæ at base and apex, the posterior tibiæ, and all the tarsi varying from pale to dark testaceous; calcaria pale testaceous; pubescence grey and sparse, except on the posterior tibiæ and tarsi; wings sub-fuscous, lighter at base, median nervure pale testaceous, remaining nervures blackish, tegulæ testaceous with a yellow spot.

Long. 7—9 mm.

Habitat—Quetta; common.

This species may easily be distinguished from *C. viridissima* by its sub-fuscous wings. Of the European species it is nearest to *C. tibialis* (Mor.), but is without any carina on the penultimate abdominal segment.

CERATINA LÆVIFRONS (Mor.).

This species is common at Quetta.

ERIADES TENUIS, n. sp.

♀ Finely and very closely punctured, head and mesonotum almost granular, mandibles with a median longitudinal carina, not reaching the base; clypeus very convex, transverse at apex; 2nd joint of flagellum much shorter than the 1st, and about half its width; punctures at the sides of the mesonotum coarser and larger than in the middle; base of median segment depressed, the depressed portion narrow in the centre, where it is longitudinally striate, and wider at the sides, where it is obliquely rugose, remainder of segment smooth; all the tibiæ very large, apex of intermediate tibiæ on the outside produced, almost dentate; abdomen nearly as long as head and thorax united. Black, calcaria testaceous; pubescence grey, very sparse, and forming narrow bands on apical margins of abdominal segments 1—3; on the posterior tarsi the pubescence is rather long, and has a golden tinge; scopa greyish-white, sparse, wings sub-hyaline, nervures and tegulæ piceous.

Long. 6 mm.

Habitat—Mount Abu; two specimens.

This species is nearest to *Heriades parvula* (Bingh), from which it may be distinguished by the absence of an impressed line on the 2nd abdominal segment. In the spelling of the generic name I follow Friese.

CŒLIOXYS PERSEUS, n. sp.

♀ Head pubescent, hiding the sculpturing; thorax deeply, but not very closely, punctured, especially the scutellum, which is almost bare and shining; abdomen finely and sparsely punctured, apical segment impunctate; head as broad as thorax, eyes very slightly converging below; scutellum with its posterior margin rounded and upturned, the lateral teeth short and blunt; median segment vertical; abdomen about half as long again as head and thorax united, conical, the apical segment long, tapering to a point, ventral plate slightly longer than the dorsal. Black; pubescence snow-white, thick on clypeus and front; on thorax, legs and abdomen formed of white scales, with two small spots at base of scutellum, and narrow interrupted bands on the margins of segments; on the inside of all the tarsi it is fulvous or golden; tarsi reddish-black, calcaria rufo-testaceous; wings hyaline, darker towards apex, nervures and tegulæ black.

♂ Similar, smaller, all the abdominal segments with minute lateral spines, penultimate segment with small blunt lateral teeth, apical segment with six teeth, all long and acute, two being lateral and the remainder apical, of which two are above and two below.

Long. ♀ 10 mm. ♂ 7-8 mm.

Habitat—Mount Abu; four specimens.

The present may be distinguished from any other Indian species by the posterior margin of the scutellum being turned upwards.

Crocisa elegans (Mor.).

Fairly common at Quetta.

Eucera medusa, n. sp.

♀ Head and thorax closely, but not very finely, punctured, granular, abdomen closely and finely punctured, the punctures shallower towards the apices of the segments, the extreme apices impunctate, shining; clypeus sub-porrect, its anterior margin transverse; postscutellum raised and prominent; no triangular or semicircular space at base of median segment; abdomen as long as head and thorax united. Black; the margins of ventral abdominal segments and the apical 3 or 4 joints of all the tarsi rufo-testaceous, calcaria pale testaceous, antennæ reddish-black; pubescence on head greyish-white, clypeus bare; on thorax thick, somewhat short, ashy grey; on abdomen grey on basal segment, with thick bands of short depressed white hairs on apical margins of segments 3—5, and a trace of a similar band on apical margin of 2nd segment, the bands on 3rd and 4th segments very broad; apices of ventral segments sparsely ciliated with greyish hairs; pubescence on legs and scopa greyish, fulvous on the inside of all the tibiæ; wings very short, sub-hyaline, nervures and tegulæ dark testaceous; only two cubital cells.

Long. 12 mm.

Habitat—Quetta; three specimens.

This genus is divided into two sub-genera by Friese (*Apidæ Europæ, viz.*, *Eucera*, with two cubital cells, and *Macrocera*, with three. The generic name *Macrocera* has the priority over *Tetralonia*. Several species of *Tetralonia* have been previously recorded from India, but I believe that true *Eucera*, with only two cubital cells, has not been previously obtained within Indian limits. The present species is nearest to *E. melaleuca* (Mor.) from *F. Turkestan*, which however has the scopa black.

EUCERA DIANA, n. sp.

♀ Head and thorax closely, but not very finely, punctured, granular, abdomen closely and finely punctured; clypeus sub-porrect, its anterior margin transverse; the sculpturing of the thorax hidden by the pubescence; abdomen scarcely as long as the head and thorax united. Black; the apical three or four joints of all the tarsi and the margins of ventral segments rufo-testaceous, calcaria pale testaceous; pubescence on head greyish, clypeus bare; on thorax and base of 1st abdominal segment long, greyish fulvous; abdomen with bands of white pubescence on apical margins of segments 1—5, that on 1st segment narrow and interrupted in the middle; legs and scopa with greyish fulvous pubescence, apical margins of ventral segments ciliated with fulvous, the tarsi inside with similarly coloured pubescence; wings sub-hyaline, nervures black, tegulæ testaceous; only two cubital cells.

Long. 12-13 mm.

Habitat—Kashmir, 5,000 ft.; two specimens.

This species is very near the last, but can be distinguished from it by the larger wings, black nervures, and narrower abdominal bands.

EUCERA MELANOSTOMA (Mor.).

One specimen from Quetta.

EUCERA (MACROCERA) PHRYNE, n. sp.

♀ Clypeus closely and regularly punctured, remainder of head and thorax with the sculpturing hidden by the pubescence; abdomen minutely and closely punctured. Black; the mandibles at base, and clypeus pale yellow; anterior margin of clypeus and labrum brownish testaceous; mandibles at apex and antennæ red, the basal three joints of the latter brownish black; calcaria and apical two or three joints of tarsi rufo-testaceous ; 1st and 2nd ventral abdominal segments brownish testaceous; clypeus bare ; colour of pubescence as follows—on labrum greyish fulvous, on front and cheeks white, on occiput pale fulvous, on thorax above thick rich fulvous, below and at the sides greyish to pale fulvous, at base of 1st abdominal segment pale greyish fulvous ; 1st segment at apex bare, 2nd and 3rd with basal bands narrowed or interrupted in the centre, 4th with broad entire apical band, all of snow-white short pubescence, 4th and 5th segments with short velvety black pubescence at base ; abdomen below with fuscous or black pubescence ; anterior and intermediate legs with greyish fulvous pubescence, except on the intermediate tarsi, where it is of black and grey hairs intermixed ; posterior tibiæ and tarsi with white pubescence above, black below ; wings sub-hyaline, nervures dark testaceous to black, tegulæ rufo-testaceous ; three cubital cells.

♂ Similar, the antennæ as long as the whole body, only the basal joint black or blackish brown ; the pubescence on the thorax is somewhat paler fulvous, 2nd to 5th segments with basal bands of snow-white pubescence, the bands somewhat narrowed in the middle ; all the legs with grey pubescence above, below fulvous intermixed with black hairs.

Long. 11-12 mm.

Habitat—Deesa ; not uncommon.

Nearest to *Eucera* (*Tetralonia*) *punctata* (Cam.), but larger, and differs in the colour of the pubescence on the abdomen.

EUCERA (MACROCERA) POMONA, n. sp.

♀ Head, thorax, and abdomen with the sculpturing hidden by the pubescence ; abdomen shining through the pubescence ; anal rim very finely transversely striate. Black ; calcaria and all the claws at base rufo-testaceous ; abdomen below with all the segments more or less testaceous at the margins ; pubescence as follows—on clypeus and labrum short, thick, greyish white ; on front long, grey, with some black hairs along both margins of the eyes and on vertex ; on thorax above greyish, with a fulvous tinge, below grey ; on abdomen, 1st segment long, grey, sparse towards apical margin ; 2nd segment greyish, somewhat sparse, apex with a widely interrupted band of white hairs ; 3rd, 4th and 5th segments velvety black at base, with bands of snow-white hairs on apical margins, the bands thick, that on 3rd segment widely, on 4th segment narrowly interrupted in the middle, that on 5th segment widely interrupted, but less widely than the band on the 5th segment; on 6th segment sparse and blackish, white laterally; ventral segments at apex ciliated with greyish, 4th and 5th segments with white hairs; on all the legs grey above, on anterior tibiæ below inclining to fulvous, on intermediate tibiæ below, and on posterior tibiæ and tarsi below black; wings hyaline, three cubital cells, the 1st recurrent nervure is received into the 2nd cubital cell near its outer angle; nervures and tegulæ black.

♂ More slenderly built; antennæ when thrown back not quite reaching the apex of abdomen. Black; the centre of the clypeus yellow, calcaria and base of claws rufo-testaceous, ventral segments obscurely testaceous at margins; pubescence as follows—on head similar to that of ♀, but on clypeus and labrum very long silky white, almost concealing the yellow of clypeus; on thorax and first two abdominal segments grey; on remaining segments black, with some long white hairs laterally; all the legs with greyish pubescence, intermixed with some black hairs.

Long. ♀ 14 mm. ♂ 12 mm.

Habitat—Quetta; extremely common at fruit tree blossoms in March. The males seem to largely outnumber the females.

This species is near to *Eucera vernalis* (Mor.). The ♀, however, can be distinguished by the white apical bands on the abdominal segments being interrupted, and the ♂ by the labrum being black and not yellow. I have a large number of specimens, and they seem remarkably constant in the colouring of the pubescence.

EUCERA (MACROCERA) CASSANDRA, n. sp.

♀ Clypeus closely and somewhat coarsely punctured, scutellum closely and finely, median segment somewhat rugosely, punctured, remainder of sculpturing of head and thorax hidden by the pubescence; abdomen with the bases of segments 1—4 closely and finely punctured, their apices depressed, and except the 1st segment, which is bare at apex, having broad apical bands of thick, short, greyish, depressed pubescence. Black; the mandibles at base, and clypeus, except its anterior margin, bright yellow; labrum and antennæ piceous or rufo-piceous, the former sometimes yellowish at base; anterior margin of clypeus, and apical joints of tarsi, more or less rufescent; apical margins of abdominal segments pale testaceous, but the colour, except in the 1st segment, hidden by the pubescent bands; calcaria pale; the lateral and apical margins of ventral abdominal segments more or less testaceous ; pubescence griseous, snow-white, or nearly so, on front and on the sides of median segment ; basal and apical margins of abdominal segments 2—4 and the whole of segment 5 with short creamy-white pubescence, this being often abraded at the basal portion of the segments ; anal fimbria and pubescence on inside of posterior tarsi with an inclination to fulvous ; wings hyaline, nervures and tegulæ testaceous.

♂ Similar to the ♀ as regards the sculpturing ; labrum yellow, as well as the clypeus and base of the mandibles ; 3rd and following joints of flagellum of antennæ light-red below; the testaceous margins of abdominal segments much narrower, and the bands, as well as the whole of the head and thorax, less pubescent ; pubescence on inside of posterior tarsi bright fulvous ; nervures inclining to red.

Long. ♀ 11-12 mm.; ♂ 9-10 mm. ♂ antennæ 7 mm.

Habitat—Quetta ; Peshin ; common in May.

The ♀ seems to be allied to *Eucera radoszkowskii* (Mor.) The ♂ is perhaps nearest to the same sex of *E. spectabilis* (Mor.) and *orientalis* (Friese), but may be at once distinguished by the flagellum of antennæ being almost entirely light red below.

EUCERA (MACROCERA) SPECTABILIS (Mor.).

Common at Quetta.

EUCERA (MACROCERA) TURCESTANICA (Dalla Torr.).

I identify with some doubt some Quetta specimens as this species.

PODALIRIUS VEDETTUS, n. sp.

♀ Clypeus and front closely and finely, labrum more coarsely and rugosely, punctured, mesonotum under the pubescence very finely and closely punctured, abdomen impunctate ; clypeus sub-porrect, its anterior margin transverse ; cheeks between lower margin of eyes and mandibles narrow but distinct ; antennæ with the 2nd joint of flagellum longer than the three following united. Black ; colour of pubescence as follows:—On head above grey, below white ; on thorax above fulvous, fulvous grey, or grey, below grey ; 1st abdominal segment with long greyish or fulvous pubescence, and a narrow ciliated band of lighter grey ; 2—4th segments with short black pubescence at base, sometimes intermixed with grey hairs, their apices ciliated with bands of greyish pubescence, which sometimes inclines to pale fulvous ; 5th segment in the centre black, with long white lateral hairs ; all the ventral segments ciliated with greyish white hairs; all the legs with grey pubescence, sometimes mixed with black hairs; scopa white; posterior tibiæ and tarsi black below; all the calcaria black; wings hyaline or sub-hyaline, nervures and tegulæ black.

♂ Labrum and clypeus anteriorly with shallow punctures, remainder of head and thorax apparently impunctate, the pubescence hiding the sculpturing; abdomen finely aciculate, with a few fine punctures; clypeus sub-porrect, very convex, its apex transverse in the middle, the sides rounded; a short carina between the bases of antennæ. Black; the labrum, except a narrow line all round and two semicircular spots at its basal angles, the clypeus, except two irregular quadrate spots at its base, an irregular mark on the front above the clypeus, extending a short way upwards along the inner orbits of the eyes, but not reaching as high as the base of the antennæ, and the scape of the latter yellow; the tarsi, except their basal joint, more or less testaceous; pubescence dense, on the head griseous, mixed with a few black hairs; on the thorax and first two abdominal segments it varies from griseous to pale fulvous; on the 3rd and following segments it is black, the margins of segments being more or less fringed with long griseous hairs, pygidium sub-triangular, with stiff fulvous hairs; legs with long pubescence, griseous intermixed with black, the inside of anterior tarsi with short fulvous pubescence; metatarsi of intermediate legs with a very large tuft of black pubescence, the longer hairs white at the tips, tibial calcaria pale; wings hyaline, nervures dark testaceous, almost black, tegulæ black.

Long. ♀ 12-15 mm. ♂ 12-13 mm.

Habitat—Kashmir, 5,000 ft.; Quetta; Peshin; common in March and April.

The ♂ is very like the same sex of *P. sichelii* (Rad.), but the ♀ bears no resemblance to that species.

PODALIRIUS CONNEXUS, n. sp.

♀ The sculpturing almost entirely hidden by the pubescence; clypeus finely rugose, mesonotum finely punctured, abdomen minutely and closely punctured; clypeus large, sub-porrect, with a median longitudinal carina not reaching its apex, its anterior margin arched; antennæ with the 2nd joint of the flagellum equal in length to the following four united. Black; the claws at base rufous, apical joints of tarsi rufo-piceous, calcaria piceous; pubescence grey above, with a slightly fulvous tinge on the 1st abdominal segment, on front and below lighter grey; on the vertex and along the inner orbits of the eyes are black hairs intermixed with the grey; the 2nd, 3rd and 4th abdominal segments are strongly fringed at apex with white or whitish pubescence, 5th segment with black, fringed laterally with whitish pubescence; on the anterior legs the pubescence is somewhat sparse and fuscous grey; on the intermediate and posterior tibiæ and tarsi it is bright fulvous outside, black inside; wings hyaline, nervures and tegulæ piceous.

♂ Second joint of flagellum equal to next three united. Black; clypeus rather pale yellow, claws and apical tarsal joints more or less rufo-testaceous, calcaria piceous; pubescence grey above, blackish on apical two abdominal segments, below whitish, very long and silky; clypeus and front with very long silky white pubescence, fringed with black hairs on vertex and along inner orbits; legs with long grey pubescence, apical joint of intermediate tarsi with a very slight tuft of black hairs, many of the spines on the tarsi rufous or rufescent; wings hyaline, nervures and tegulæ piceous.

Long. 12-13 mm.

Habitat—Quetta; not uncommon at fruit tree blossoms in the early spring.

The ♀ is nearest to *P. testaceipes* (Mor.) and *P. chrysocnemis* (Mor.). From the former it can be distinguished by the pubescence on the inside of the posterior tibiæ and tarsi being black; from the latter by the pubescence on the thorax being greyish and not yellow.

The ♂ is nearest to *P. ventilabris* (Leq.) from Algeria, but can be distinguished by the pubescence on the thorax being grey and not rufous.

PODALIRIUS SERGIUS, n. sp.

♀ Differs from the same sex of *P. connexus* above in being constantly smaller, and in the pubescence on intermediate and posterior tarsi being grey and not fulvous.

♂ Differs from the same sex of *P. connexus* in being smaller, and in having the labrum, scape in front, and a small mark on the inner orbits of the eyes yellow.

Long. 11·12 mm.

Habitat—Quetta; common in the spring; it appears somewhat later than *P. connexus*.

I took ♀ and ♂ of this species in coitu. Both sexes of this species are allied to *P. uljaninii* (Fedt.); the ♀ however differs from the same sex of that species in having the scopa grey and not fulvous. The ♂ I identified as *P. uljaninii* until I got a specimen in coitu with the ♀ as above described; the only difference which I can detect between them is that the tuft on the apical joint of the intermediate tarsi is much smaller in the present species than in *P. uljaninii*, in fact it is scarcely noticeable as a tuft.

The genus *Podalirius* is common at Quetta, and I obtained the following species not previously recorded from India:—

P. picicornis (Fedt.).
P. albigenus (Lep.).
P. orientalis (Mor.).
P. fulvitarsis (Brullé); one specimen.
P. atricillus (Everimann); one specimen.
P. velocissimus (Fedt.); common.

THE WILD PLANTAIN (*MUSA SUPERBA*, ROXB.)

By G. M. Ryan, I.F.S., F.L.S.

With a Photograph.

(*Read before the Bombay Natural History Society on* 16*th June* 1904.)

It had been raining very heavily for two or three days during the latter end of May 1903, and as conditions looked very much as if the rains had set in I asked a cultivator who came to pay me a visit whether the monsoon had really begun, whereupon he smiled and answered with a very confident air in the negative. Asked why he was so certain of this he said " Well, sir, the wild plantain has not thrown out its new leaves yet. As soon as the plant does this we know the monsoon is at hand;" and my friend the cultivator was right.* The monsoon had not burst, although it seemed at the time uncommonly like it. The rain that then came down was the accompaniment of a severe cyclone, the like of which has not been recorded in Thana for about 300 years.†

The force of the wind is reported to have been 100 miles an hour and over half a million trees (Teak and the Palmyra Palm especially) were blown down‡ in the forests and non-forest lands of the Dahanu, Mahim and Bassein seacoast Talukas of Thana.

It is about this apparently insignificant plant to which the cultivator alluded therefore that it is proposed to record some notes, and it will be gathered from them that in addition to its utility as a sort of jungle barometer the wild plantain root-stock and leaf-sheaths form economic products of no inconsiderable value.

It perhaps may be interesting to mention here parenthetically that near the end of the rainy season the Foorsa (*Echis carinata*) finds a resting place between the leaf-stalks of the wild plantain leaves.§ He probably seeks this cool retreat as a sort of vantage ground for making his depredations.

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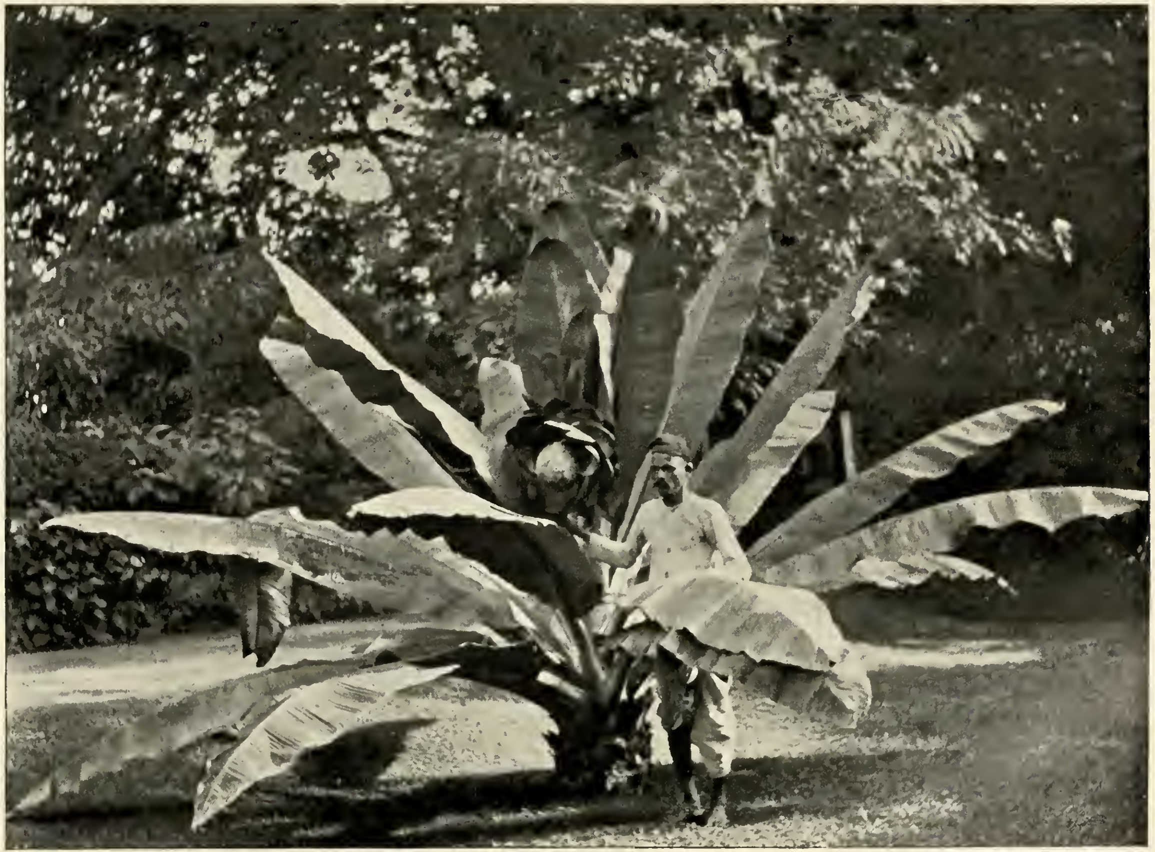
* Karvi—*Strobilanthes callosus*, Nees—is another plant which is looked upon as a similar sort of jungle barometer.

† In the Gazetteer (Thana), Vol. XIV, p. 31, a severe storm is reported to have occurred in Bassein in May 1618. " Thousands of palms were torn up by the roots and some the wind lifted through the air like feathers and carried great distances."

‡ Large numbers of the Palmyra Palm were also beheaded.

§ He is also fond of inhabiting the branches of the " apta " (*Bauhunia racemosa*) tree—a tree the leaves of which are collected and sold for native cigarettes (Bidis) in Bombay.



Mintern Bros., Photo-Eng., London.

MUSA SUPERBA.

It is in the Bassein vegetable gardens that most of the fruit of the red and yellow and green varieties of plantains which are sold in the Bombay Bazaars are so extensively cultivated, and while their utility is well known, few are aware of what economic value the wild plantain is to the wild tribes in the Thana District. It is not the fruit however in this instance which is of edible value and so much prized although the latter is eaten to some extent by the people and also as a vegetable when unripe. The portion which is so eagerly sought after and which in ordinary as well as famine years is eaten so extensively is the base of the subarborescent stem consisting of the sheathing leaf-stalks and their subterranean root-stock.*

The latter is not stoloniferous, *i.e.*, new shoots are not thrown up from it annually as is the case with the cultivated species *Musa sapientum*.†

The plant is familiarly known by the wild tribes as "Kawdur:" the more intelligent classes call it "Chaveni" and also "Rankel." Two varieties are found, one which grows to the height of about 7 feet and the other to the height of about 3 or 4 feet.

In the Bassein Taluka the large variety is known as "Sonkel" and the small variety as "Masrikel." Near Kharbao on the Bassein creek the people give the name of "Dulikel" to the variety which flowers early and "Gudvikel" to the variety which flowers late. In parts of Central Thana the plants are called "Dharna" and "Ghandvalia" respectively. In the Dahanu Taluka, North Thana Forest Division, the names are "Kowdar," "Chawa" and "Chawaee."

Both varieties may be seen all over the Thana District, being perhaps more abundant in the Mokhada direction, a tract of country which forms the western projection of the Ghats, at about 1,800 ft. than elsewhere. On the Ghats themselves and between Karjat and the Reversing Station, near Khandalla especially, the plant may be seen from the railway train, and it is particularly noticeable in the rains about August or September when in full leaf.

An excellent illustration of one of these plants grown in Mr. M. R. Jardine's garden on Malabar Hill, Bombay, is shown in the accompanying plate which is from a photograph taken by Mr. N. C. Macleod.

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* Wild pig are very fond of the root-stock also. They burrow underground to attack it.

† I found one instance in the Mahim Taluka of a wild plantain bearing a stoloniferous root.

The plant was brought from Khandalla by Mr. W. S. Millard, one of the Honorary Secretaries of the Bombay Natural History Society, in June 1900, and it flowered for the first time early in October 1903.

In the lower parts of the Thana District *Musa superba* is found generally in rocky ravines and on rocky hill slopes in a forest.

In some instances it grows in the forks of trees.*

Its existence in such places, and especially the latter, needs an explanation.

The monkey is responsible for its presence there. He is very fond of the fruit and is mainly responsible for the distribution of the seeds, which are very hard and comparatively heavy and black.†

When he eats the fruit while perched on a tree the hard black seeds inside are discarded and in falling either drop to the ground or lodge in a tree. Those seeds which fall to earth are washed down into the water courses and rocky ravines, while others fall in the crevices of rocks on the hill slopes, a locality which monkeys usually haunt.

The plant possesses the property of economising moisture to the greatest possible extent by storing the same in its succulent leafstalks and excavated sheaths which enables it to grow and thrive in arid situations, such as the rocky localities alluded to, where moisture in the soil for the greater part of the year is entirely absent. This property is possessed by many desert and "rock" plants, as is well known, particularly so by the common prickly pear which may be seen growing and flourishing on the summit of stone walls in and about Bombay.

Its ability to do this rests mainly in the fact that the water taken up by the roots, instead of being liberated by transpiration (as in the case of plants growing in ordinary situations) from the parts above the surface of the soil, is retained and re-utilized in the extreme dry season to keep the plant alive. In order to further obstruct transpiration from the exposed surfaces, spines are developed instead of leaves.

A detailed account of the manner in which desert and "rock" plants adapt themselves to their environment in this way and the causes of their morphological features may be seen by a reference to Rev. G.

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* Instances of this have been met with in the southern side of Mahuli Hill in the Shahpur Taluka and in the Kashti Forest, Mokhada. In the latter case it was Mr. Clayton, I.C.S., who drew my attention to the interesting phenomenon.

† "Kal Manjur," a species of wild cat (black), is also very fond of the fruit and distributes the seeds by swallowing and excreting them.

Henslow's interesting work entitled "The Origin of Plant Structures."

Ravenala madagascarensis, a handsome tree of the plantain-tribe, specimens of which may be seen in Bombay in the Victoria Gardens and in one or two private gardens near Malabar Point, with its large plantain-like leaves growing in one plane forming a semi-circular head like an open fan, is known as "The Traveller's Joy" because of the large quantity of water which is stored up in the excavated sheaths and succulent leaf-stalks.

It is alleged that a quart of water may be readily obtained in driest weather by piercing the leaf-stalk.*

It may be interesting here to mention in this connection that a common climber known as Nandanwel (*Vitis adnata*, Wall) is found in the Thana District, whose stems when cut bleed so profusely as to provide sufficient liquid for quenching the thirst. When very thirsty and unable to obtain water from any other source the wild tribes drink the fluid, which causes however throat irritation. Even a still larger quantity of liquid and certainly more agreeable to take than that of Nandanwel, in that no throat irritation succeeds swallowing, is the fluid which flows from the cut stems of *Calycopteris floribunda*, Lamk,† known as " Ukshi " in Thana and abundant almost all over the district, especially in the western parts, a specimen of which may be seen on the Gibbs Road, Malabar Hill, Bombay. When in flower this particular plant presents a very handsome sight covered as it is with a profusion of yellowish flowers.

The plant however possessing the fluid (which is usually obtained in April-May) is a scandent shrub and a very formidable one in the bargain, for once it mounts a tree it invariably succeeds in reaching the illuminated heights of the crown which it so invades with its tangled mass of branches that the host is soon exterminated. In the Flora of British India, however, *Calycopteris floribunda* is described as "a diffuse dense shrub . . . . with drooping branches not at all scandent." Its habit of growth when standing isolated as on Malabar Hill, for instance, meets the above description it is true, but no doubt exists about it being a very formidable climber in the forests. The wild plantain possesses no real stem above ground. What is popularly known as the stem is a spurious herbaceous shoot composed of the closely packed convolute leaf-sheaths. At the base of these imbedded in the ground is a tuberous root-stock which may be termed the true stem. This portion as well as that immediately above it, *viz.*, the convolute leaf-sheaths, are the parts so much prized and consumed by the wild tribes. These portions were chemically analysed at my suggestion and the report of their analysis, which has been courteously supplied to me by Mr. Burkill, Reporter on Economic Products to the Government of India, and which was made at Mr. Burkill's request by the kindness of Mr. A. Ghose, a chemist in the employ of a Calcutta mercantile firm, is as follows:—

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* Chambers' Encyclopædia.

† I have tasted this liquid which at first has a clear transparent appearance like water. If bottled, however, it turns the colour of vermouth.

Report.

"Percentage composition of the stem below the leaf bases:—

Moisture	67·56
Albumenoides	4·89
Ash	1·74
Digestible fibre	13·6
Woody fibre	8·3
Tannin, sugar, etc.	3·91
Total ...	100

Percentage composition of the leaf bases—

	Outer portion.	Inner portion.	Central portion.
Moisture	79·5	74·6	74·
Ash	1·65	1·62	2·14
Albumenoides	2·84	2·92	2·66
Digestible fibre	12·07	17·31	17·01
Woody fibre	2·53	2·1	2·31
Tannin sugar, etc.... ...	1·41	1·45	1·88
Total ...	100	100	100

Note.—For the estimation of moisture, crude and woody fibre, freshly cut portions were used. The amount of Nitrogen and Ash was determined in dry powdered substance and the results were reduced to percentages of the original sample."

Mr. Burkill adds in forwarding the report that "the parts sent for analysis are rather . . . innutritious," and while the above chemical analysis betrays this it is a curious circumstance how, nevertheless, the analysed portions are so much prized and consumed.

When a Kathodi or Koli comes home after a hard day's work from the forests it is quite a familiar sight to find him bringing home one or two wild plantain herbaceous shoots weighing 8lbs. to 10lbs. each. Out of 30 to 40 of such wild tribesmen who were returning home from the forests in Indian file up a hill during the season of 1900-01 in Mokhada when distress existed in the district, almost every adult was observed carrying one and perhaps two Kowdurs adjusted at both the ends of a pole which was slung across his shoulders.

The ordinary method of preparing the sheathing leaf-stalks for food is by stripping them and boiling each separately. Each sheath is eaten in the manner of artichokes, the fibrous portion being thrown away.

The root-stock or tuberous portion below ground is boiled, sliced and eaten. This is considered more nutritious. But the more interesting method of preparation of the plant is by cooking the whole root-stock and convolute leaf-sheaths together in an improvised oven as follows :—

A large circular pit 7 feet diameter is dug to the depth of about 2 to 3 feet, at the bottom of which is placed a quantity of hay. Over this several billets of firewood are laid and on the latter is arranged a layer of large round boulders (about 3 feet in circumference each) closely packed together. The heap so formed is ignited and allowed to burn for several hours till the stones are red hot and fall in. Above this disordered heap of red hot stones are arranged the Kowdurs 15 or 16 in number placed upright.

The latter are then covered over and closely packed together with tahal, *i.e.*, branch-wood and leaves, over which a layer of soft fine earth 1 to 2 inches deep is spread. When completed the heap assumes the shape of a conical mound not unlike that of an ordinary jungle charcoal kiln. At the apex of this mound is placed a Kowdur, the root-stock being concealed in the earth, the remaining portion standing erect outside.

The heap is left for about three days smouldering when the Kowdur at the apex is examined to see if the root-stock is sufficiently cooked. If so the heap is opened and the Kowdurs inside are then removed and found to be ready. They then present a russet brown appearance and are very soft. The thin outer sheathing leaf-stalks are peeled off in this state and the inner more succulent parts are thus eaten. Their flavour is not at all unpleasant, as a lady, the wife of the Collector of the District, who tasted some of them immediately after removal from the improvised oven, agreed.

The practice of preparing the Kowdurs in this manner is restricted and has almost ceased in some places since the introduction of forest conservancy in Thana, because for their preparation a large quantity of firewood is needed. In some instances pits large enough to hold 300 or 400 Kowdurs are dug. The cooked inner succulent leaf-stalks are then peeled and dried in the sun for 3 or 4 days when they become quite brittle. They are subsequently pounded into the consistency of flour and stored for the rains in bins. The resulting flour is then mixed with bread chiefly, and eaten.

In the central parts of Thana and more especially in the Wada Taluka cattle are stall fed on the leaves. In the Kolaba District and parts of Thana, as at Saoroli in the Dahanu Taluka, the plant is specially cultivated in small gardens for its leaves which serve as dinner plates. The wild tribes in Bassein collect them in the forests in August and September and sell them to merchants who export them for sale as dinner plates to Bombay.

The flowers which are a very pale yellow, almost white, appear at about the end of July to September when the plant is full grown.

This in some cases is 4 years and in others 6 or 7 years. The fruits begin to appear in August and continue appearing up to the end of January after which the plant dies. The flowering and pruning stalk is known as "Longra."

In parts of the Konkan the seeds are eaten as a prophylactic against small-pox. In the Chiploon Taluka of the Ratnagiri district the practice is said to be common during an epidemic of small-pox as I am informed by one who is a resident of that taluka and who has eaten the seeds himself for this purpose. They are also used as a specific in hydrophobia in the Bassein Taluka.

Three drachms (by weight) of the powdered seed are mixed with one ounce and five drachms of water and the preparation is strained through cloth and taken as a dose which is administered morning and evening.

The Patel of Dahisar in Bassein states he has used this remedy with considerable success. It would be interesting to ascertain whether there is any real virtue in the seeds in this respect.

The fruit of the cultivated plantain is said to be also eaten during an attack of small-pox to hasten maturation of the disease.

From the midrib of the leaf of the wild plantain fibre is extracted which is obtained after the leaf is well dried. This fibre is utilized locally in Bassein in the preparation of well ropes.

In the Wada Taluka it is used by shop-keepers to tie up small parcels and also in the preparation of floor matting. Fibre from the outer sheaths of the subarborescent stem is also extracted and utilized as cordage, etc., but this latter of course is a negligable quantity.

It can be gathered in conclusion that the wild plantain is an extremely interesting subject for study from an economic point of view ; and that it is a very handsome plant and one which would be an ornament to many a lawn for several seasons is evident from the excellent photograph accompanying this paper, which Mr. W. S. Millard obtained of the specimen which he brought down from Khandalla, and which burst into flower in October last. Alas, now it is no more.

THE DISTRIBUTION OF BUTTERFLIES IN INDIA.

By L. C. H. YOUNG, B.A., F.E.S.

(*Read before the Bombay Natural History Society on 25th February* 1904.)

I WOULD have liked to have written a paper on the distribution of insects generally in our area, but unfortunately our knowledge of most orders is at present too fragmentary for me to attempt it. I have, therefore, confined myself to a single group of the Lepidoptera—the butterflies—about which we can now speak with considerable certainty. At the same time, the broad conclusions at which we may arrive will probably be at least equally true of all other orders.

Mr. Comber in a recent paper described the limits of the Oriental region to which the greater part of India belongs. It remains to speak in detail of some of its sub-divisions. India falls into 4 regions—(1) the Himalayas west of Sikkim, with Cashmere; (2) the Indo-Gangetic plain; (3) The peninsular area, *i.e.*, the whole of India south of No. 2 and including Ceylon; (4) Assam—using the term in the wide sense of the proposed new province (and including the Bhotan Terai) which shades indefinitely into the Chinese and Burmo-Siamese regions.

The insect fauna of No. 1 is in the main *palearctic* though containing a large number of immigrant oriental species on the lower slopes, the proportion increasing eastwards so that, coupled with our present ignorance of the insects of Nepaul, it is impossible to draw a satisfactory boundary between this region and No. 4.

No. 2. The Indo-Gangetic plain has no proper insect fauna of its own. The scanty lists of species to be obtained there contain nothing but common immigrant species from the surrounding regions.

In our present ignorance of Southern China it is not possible to characterize adequately the fauna of No. 4.

In this paper I want to deal only with No. 3, the peninsular or Indian area proper. This country falls into 4, or perhaps 5, natural regions. There is the central more or less treeless plateau of Malwa, and what is loosely termed the Deccan, which corresponds in poverty of species to the Indo-Gangetic plain. To the north and east of these there is a wide area including the greater part of the Central Provinces, Bundelkund, Chota Nagpur, Orissa and the Northern Circars, which for want of a better name I am calling Gondwana. To the west lies the Konkan stretching from the Tapti to the Goa frontier and comprising the well-watered mainly forest area between the sea and the crest of the Ghâts. South of the Konkan from Goa to Cape Comorin is the rich forest area of Malabar, in which I am including Canara and the lower slopes of the Nilgiri and other hills in the south. The Mysore plateau and Carnatic form a fifth region which we may call South Indian, differing only from the Malabar in its comparative poverty of species, the result of extended cultivation and limited rainfall.

In addition to the above there are two attached island areas, Kach and Kattiawar to the north-west and Ceylon to the south. The Kach-Kattiawar island or islands seem to be remarkably poor in species, but they have not been thoroughly worked ; of Ceylon, of course, we have fairly accurate information.

(The fauna of the Andamans is rather Indian than Burman, but it will be best not to complicate the present paper by a discussion of these interesting islands.)

The higher slopes of the mountains of Southern India and Ceylon present certain peculiar features which almost warrant their being erected into two additional regions. Almost all the species which are peculiar to Ceylon belong strictly to the mountains, the insect fauna of the plains practically not differing from similar country north of the Straits.

Now these regions into which the insect distribution is easily divided agree, as has been shown, with the superficial and meteorological characteristics of the country. A glance at a geological map will show that they correspond also with its past history.

It is a general rule in the distribution of animals that an island fauna is much poorer than that of the neighbouring continent. But in the Oriental region we find the Indian, or what is now the continental part, much poorer than the Malayan islands. This is because throughout geological history down to the tertiary period the position appears to have been exactly reversed. The peninsular area was an island, the Indo-Gangetic plain an open sea, the Himalayas much lower and much further north than at present (they seem to have been raised to their present form by lateral pressure from the north just as one might push up a crease in the table cloth).

The Arabian Sea would thus have been connected at least in cretaceous times by a tolerably broad channel with the Caspian and Aral Seas which are the remains of a large sea covering Persia, N. Arabia and the Kirghiz steppes, Southern Arabia cut off from the north and probably joined to Somaliland.

The desert of Gobi is considered to have been open sea in very recent geological times, and the Yellow Sea may have been connected with the Bay of Bengal by a narrow channel through Burmah and the Yangtse Valley—at any rate the Shillong plateau in Assam must have been an island, very near to India on one side and China on the other, and probably periodically connected with one or both.

To the south it must always have been bounded by the sea though probably larger than it is now; for a long time being connected with the Maldives and until the end of the cretaceous period if not later with the Lacadives or rather with the now sunken plateaus on which these coral islands rest.

The diminished area is sufficiently accounted for by a gradual sinking after the upheaval of the Himalayas and the constant attraction exerted by them on the tides.

It is necessary to enforce this point because many people, geologists in particular, have a habit of explaining the presence of the same genus in two widely separated regions by imagining the former existence of a connecting continent.

One of the favourite continents of this kind is "Lemuria" supposed to have stretched from Madagascar to Sumatra *via* Ceylon to account for the presence of Lemurs at both ends. When I read of these continents 10,000 miles long and 3 miles broad, stretching across bottomless oceans, I always think of a story I once heard of an American. This man had such a fearful habit of exaggerating that he used to spoil the appetites of all other guests at dinner. So one time he agreed with his host beforehand that directly he began to draw the long bow the latter should kick him under the table.

He behaved all right till desert when the conversation turned on vineries and thence to hot houses generally. Then he began "Ah, but "you should see the hothouses in my country! In New York City "there's a State conservatory that's 22 miles long and 600 feet high "and—ough—ah" (and then as he stooped to rub his shins) "er—er—2 inches broad!!"

Well to my mind it would be as easy to believe the lemurs swam the whole distance as that they should have ambled along a causeway like that, and why were the lemurs practically the only creatures to make the trip? Certainly as far as butterflies are concerned there is nothing to suggest such a connection.

You would have thought Dr. Wallace had knocked the bottom out of this kind of reasoning long ago, but he hasn't, for I see the Indian geological surveyors still take Lemuria for granted, and quite recently were excited about another continent cutting across it joining Trichinopoly to Patagonia!

Dr. Wallace lays down a general principle that we are not justified in supposing any part of the earth's surface, which is now over 1,000 fathoms below the sea, was formerly dry land, and certainly practically all the facts are easily explained without going beyond the 500-fathom line.

To return to our Indian island the chief fact about its geology is the antiquity and regularity of its formation. Outside Gondwana, where there were slight changes of level in early times causing some alteration of the principal water sheds, there was practically no alteration (and no evidence that any part had ever been submerged under the sea except small areas near the mouths of the Nerbudda and Cauvery) until the end of the cretaceous epoch when a gigantic upheaval of volcanic or trap rock took place. There are small areas of this rock in Assam, Chota Nagpur and Sind, but these are quite separate from, and not necessarily contemporaneous with, the main overflow which covered Gujerat, Malwa, Berar and the Bombay and Hyderabad Deccan as well as reaching about 200 miles to the west over what is now sea. This stupendous eruption, lasting at intervals for perhaps thousands of years, of course completely blotted out the fauna and flora of the N.-W. third of the island and is sufficient to account for the poverty of the Konkan region as compared with Malabar to this day.

Now to come to the insects themselves. Butterflies are divided into 7 families, and I propose to take each in order. (In doing so I ought to premise that I am only giving the number of forms which I consider truly entitled to be considered species ignoring many described varieties which do not warrant the distinction, and I have treated a whole host of ephemeral generic names which have no characters to justify them, in the same way.)

Of the first family, the *Nymphalidæ*, we have 71 species, of which 10 are peculiar to the region. One of these belong to a distinct genus of its own and is apparently confined to Travancore.

One is confined to the Palni and Anamali Hills and one to the Mountains of Ceylon, two allied parallel species are confined, one to Ceylon and one to the Mountains of S. India, three are confined to Malabar and Ceylon (they have been given separate names for each region, but they do not merit the distinction), while two are found in suitable localities throughout the region.

Of the remaining 61: *Six* are tolerably well-marked geographical races of species characteristic of Assam or Malaya (of these 3 are confined to Ceylon and Malabar, the rest evenly distributed.)

Two are palearctic species found in the high mountains of the south and Ceylon and must have found their way there *via* temporary halting places in the way alpine plants and insects always do wherever mountains are high enough to give the requisite climate.

Three (confined 2 to Ceylon, 1 to Malabar) which are only found in the Andamans, Nicobar or Mergni and which exhibit considerable local differences.

One cosmopolitan.

At least *two* which probably originated in Africa but are now spread throughout the east (one of them has found its way to the West Indies in historic times).

Three are Assam-Burma species which have only migrated south as far as Gondwana at present.

The remainder are found in Assam and neighbouring regions, most of them of wide oriental distribution.

The second family, the *Satyridæ*, form a great contrast to the last in that though there are only 27 species 15 are peculiar. The Nymphalidæ are mostly brightly coloured insects of strong flight. Many of them migratory in habit, moreover structurally the majority of the genera are recent developments. The *Satyridæ* on the other hand, are dark, slowflying, shade-loving insects, and this leads one to suppose that when worked out most groups of moths and other orders of insects will show as large a proportion of peculiar forms as the *Satyridæ*.

Of these 15: *One* species confined to Ceylon is a variety of a Malayan form and was possibly introduced through the botanical gardens where it first appeared. *Two* others confined to Ceylon, one of which is a complementary to *another* in Malabar.

Three confined to Malabar.

Four confined to the higher mountains of the south, two of which will probably prove to be only forms of one species.

Three found in both Ceylon and Malabar.

Two in all suitable localities.

Of the remaining ten species, one is an African form, probably a recent immigrant, as it has not yet reached Ceylon or Assam. One is an Assam form confined to Ceylon and Malabar, two are Assam forms which are not found beyond Gondwana and the remaining eight generally distributed in Assam and elsewhere.

The third family, the *Erycinidæ,* is a very small one, most developed in South America. There are only three species in the peninsular, two of which are only found in Ceylon and Malabar, and all three are well distributed in the rest of the oriental region.

The fourth family, the *Lycaenidœ* contains 86 species, of which only 10 are peculiar, and the same remarks made in comparing the first two families apply here.

Of these 10: *One,* found in all the forest regions and in Ceylon, belongs to a peculiar genus and is structurally an interesting form.

Two confined, one to Ceylon, one to Malabar, are doubtfully distinct.

Three are confined to Malabar.

Four to the higher mountains of S. India, two of which are doubtfully distinct.

Of the remainder: *three* are practically cosmopolitan, *five* are African, Arabian or South Persian, but at least two of them have spread to Burma.

Four are only found elsewhere in the Andamans, South Malaya or Java.

The remaining 64 are found in Assam and most of them in other parts of the oriental region.

The fifth family, the *Pieridœ,* contains 30 species, of which 2 are peculiar. This is a peculiarly migratory family.

These *two* are found throughout the area (one, however, is doubtfully distinct from a Persian form).

Of the remaining 28: Two, occurring on the summits of the Nilgiri, Palni and Anamalai Hills, but curiously not yet found in Ceylon, are palearctic. *Two* are practically cosmopolitan in all tropical and subtropical regions. *Eight* are Soudanese or Arabian forms, all very characteristic of Kach and Kattiawar, only four of them having spread beyond that island area.

Four are Assamese forms found also in Malabar and S. India. *One* is a Malayan species found in both Ceylon and Malabar. *Two* are Assam-Burma forms which have not spread beyond Gondwana, and the remaining nine are well distributed both in the peninsular and the regions beyond.

The sixth family, the *Papilionidæ*, contains 21 species, of which 8 are peculiar. Of these *2* are generally distributed throughout the area, *4* complementary forms are confined, 2 to Ceylon and 2 to Malabar, *one* is confined to Malabar, and one is found in Gondwana, S. India, Malabar and Ceylon and approaches an Assam form very closely. Of the remainder : *One* is found in Persia as well as the Himalayas, China and Assam and may be of palearctic origin, and the twelve others, 4 of which are confined to Malabar in our area, are found in Assam and a large part of the oriental region.

The seventh family, the *Hesperiadæ*, contains 81 species, of which 22 are peculiar. Of these no less than *6* have their nearest allies in the Philippines. *Two* are doubtful species confined one to Ceylon and one to Gondwana, *four* are confined to Ceylon, six to the Nilgiri-Palni Hills, one in both Ceylon and Nilgiris, 6 in the Malabar, one in the Malabar and Konkan, and 2 throughout the area.

Of the remainder, one found hitherto only in Kach is palearctic, three generally distributed forms appear to belong to the Himalayas and Persia, two, confined one to Malabar the other to Malabar and Ceylon, only found elsewhere in the Philippines, 15 are Assam-Burma forms ranging into S. China, and the remaining 34 are fairly evenly distributed in the oriental region.

Now all these facts amply justify a theory of Dr. Wallace that the great species-producing belt of the old world has been what is now the temperate zone of the northern hemisphere and that the southern lands obtained the most of the types of their fauna by successive waves of immigration. I pointed out in discussing the geology that the peninsular was always widely separated from everything to the north and west, and the main line of immigration would appear to have always been *via* Assam. These successive waves tend to exterminate each other, and owing to their being islands at the time of the later immigrations older forms have survived in Ceylon, the Andamans and Nicobars.

This is the only explanation of the curious resemblance between the *Hesperiadæ* of India and the Philippines. The latter group of islands are the most isolated part of the oriental region, and these species belonging to what is structurally by far the oldest family must be relics of one of the earliest migrations. The great fixity of species shown after so long a time suggests all sorts of theories on the problem of variation, such as how the tendency of forms to vary is inherent or purely climatic which must not be touched on here.

It is a remarkable thing that this great peninsular island which through countless ages was almost as isolated as Australia and with the Lacadive and Maldive extension more than half as large produces so few peculiar forms and so few of these really strikingly distinct. Of the two peculiar genera only one is likely to have been locally developed, the other being more probably a survival of forms elsewhere extinct. The only solution of this difficulty I will offer for the moment is that in cretaceous and earlier times the richest and most fertile part which would be most likely to team with life of every kind was that portion of the island which is now under the sea or buried in trap rock, while the north-east of the island was comparatively sterile and badly watered and only afforded a short resting place for immigrant species on their way from Assam to the south-west. It will be noted, too, that of existing species the majority of immigrants from Assam have not succeeded in perpetuating themselves in Gondwana and only found a permanent new home when they reached the moist area of Malabar. This is however a wild suggestion and not a solution. The older fauna, if it existed, has become extinguished by the inroad of new, more highly specialised forms since India became closely connected with the rest of the world in that mysterious way in which older forms always do before the march of younger races.

A CATALOGUE OF THE *HETEROCERA* OF SIKHIM AND BHUTAN.

By G. C. Dudgeon, F.E.S.,

With Notes by H. J. Elwes, F.R.S., &c.,

AND

Additions by Sir George Hampson, Bart., B.A., F.E.S., &c.

Part XVI.

(Continued from page 326, Vol. XV.)

Family NOCTUIDÆ.

Sub-family *AGROTINÆ.*

Genus Chloridea, Westw.

1601. *C. armigera*, Hübn.

Sikhim and Bhutan up to 6,000 feet. A very common insect at the lower elevations. The larva is most destructive to flower buds and seeds, boring into them. Considerable variation in colour of the markings occurs among larvæ ; some taken feeding on the seed-bearing heads of sunflowers were greenish with a darker dorsal and paler lateral line. I have specimens of the perfect insect taken in March, April, May, June, July and August.

1601 Pt. *C. assulta*, Guen.

Sikhim and Bhutan, 1800-2500 feet. The form *separata*, Wlk., occurs, but not commonly at low elevations. The species or rather the form of it just mentioned was included under *Heliothis armigera*, Hübn., in the Moths of India.

Genus Timora, Wlk.

1615. *T. irrorata*, Moore.

Sikhim, 1,800 feet. I have eight specimens taken by me at light at Punkabaree in October. The forewing of this insect almost exactly resembles that of *Adisura atkinsoni*, Moore, but the hindwing of the latter species is always more or less marked with black upon the outer margin, and insects of the Genus *Adisura* do not possess the strong terminal spine to the tibia of the foreleg.

T. albicilia, Hmpsn.

Sikhim, 3,000 feet. I took three specimens of this at Badamtam, but have not taken it elsewhere. The type is in the British Museum.

Genus Adisura, Moore.

1606 Pt. *A. dulcis*, Moore.

Sikhim. This has not been taken by me.

1600. *A. atkinsoni*, Moore.

Sikhim, 1,800 feet. Occurs rather plentifully in October at Punkabaree. (One specimen only from Sikhim, dated 12th October 1888, others from the Naga and Khasia Hills. It does not seem well placed here.—*H. J. E.*)

1606 Pt. *A. marginalis*, Wlk.

Sikhim. This is recorded from this locality, apparently upon the authority of several specimens in the British Museum collection, although I have never met with it.

Genus Euxoa, Hübn.

1620. *E. segetis*, Schiff.

Sikhim and Bhutan up to 4,500 feet. Occurs fairly commonly in February, March, May and July and probably later in the year. The larva does considerable damage to tea nurseries in some places, eating the young plant off close to the ground.

1621. *E. corticea*, Schiff.

Sikhim, 5,000 feet. I have only taken this at Tukvar in February and September; it does not appear to be common. (I took it at Darjeeling in May, June and August at light. Knyvett took it in March.—*H. J. E.*).

1622. *E. spinifera*, Hübn.

Sikhim, 1,800 feet. I have two males and two females which I took at light at Punkabaree. The antennæ are fasciculate with the apical portion serrate in the male. My specimens were taken in April, May and June. (I have only one from Sikhim ex coll., Möller, dated 2nd June 1888, and identified by Sir Geo. Hampson; it agrees with specimens from Ganjam and Poona.—*H. J. E.*)

1628. *E. intracta*, Wlk.

Sikhim. I have not taken this. (Two specimens in my collection from Sikhim are identified by Moore as this. The type is from Nepal —*H. J. E.*)

Genus Hermonassa, Wlk.

1676. *H. sinuata*, Moore.

Sikhim, 7,000 feet. I have taken this at light at Darjeeling and have seen other specimens taken by Colonel Pilcher at the same place. I do not think it is common. (I have five of the dark form, *cuprina*, Moore, all of which are constantly different from the reddish form, *sinuata*, Moore. I took the former at Darjeeling and as low as Rungbee, 6,000 feet, at light and both forms on Tongloo.—*H. J. E.*)

1673. *H. incisa*, Moore.

Sikhim and Bhutan, 6,700 feet. This species occurs with *H. consignata*, Wlk., but is rare.

1675. *H. lanceola*, Moore.

Sikhim, 7,000 feet. The original description must have been taken from a much faded specimen, as the examples procured by Colonel Pilcher at Darjeeling were olive-green with the markings very clear and the cilia of the forewing reddish. I have two specimens like this, dated May.

1671. *H. consignata*, Wlk.

Sikhim and Bhutan, 6,700 feet. I took this at Pasheteng attracted to light in October. No. 1674. *H. chalybeata*, Moore, is synonymous. (Common at Darjeeling in June and up to Tongloo, 10,000 feet. I am not clear as to how it may be separated from *H. incisa*, Moore, and *H. lanceola*, Moore.—*H. J. E.*)

Genus Agrotis, Ochs.

1623. *A. ypsilon*, Rott.

Sikhim, 1,800 feet up. I do not think this a common species. I have a pair only which I took at light in November. (I have two from Möller's and one from Knyvett's collection, the latter taken at high elevation.—*H. J. E.*)

1651. *A. stentsi*, Led.

Sikhim and Bhutan, 6,700 feet. I took one specimen of this at Pasheteng at light in October. It was known until recently as *A. triangularis*, Moore. (Two specimens from Knyvett's collection which agree with one from Japan.—*H. J. E.*)

1647. *A. c-nigrum*, Linn.

Sikhim. I have one specimen in my collection identified by Dr. Moore as this species, and one other taken by me is in the British Museum collection. (I took this at Darjeeling at light in July and have others from Möller's collection.—*H. J. E.*)

1650. *A. flammatra*, Schiff.

Sikhim and Bhutan, 1,800 feet. Common at some elevations in February and March. It is one of the commonest spring insects in the

Kangra Valley also. (I did not take this species myself, and believe it to be a low elevation one.—*H. J. E.*)

1648 Pt. *A. consanguinea,* Moore.

Yatung. I have not taken it, but it probably occurs at high elevation on this side of the passes also.

1648. *A. ditrapezium,* Schiff.

Sikhim, 7,000 feet. I have not seen this. (I took one specimen at light at Darjeeling which agrees with Moore's type of *renalis* identified by Sir George Hampson with *ditrapezium.*—*H. J. E.*)

1631. *A. plecta,* Linn.

Sikhim. I have not seen this. (One from Atkinson's Sikhim collection was considered by Staudinger to be *leucogaster,* Freyer, but can hardly be distinguished from *plecta* ; it agrees with Moore's type of *costalis* in Atkinson's collection.—*H. J. E.*)

1635 Pt. *A. rubicilia,* Moore.

Sikhim and Bhutan. Not common at high elevations. I have three specimens taken at about 7/8,000 feet.

1635 Pt. *A. basistriga,* Moore.

Sikhim. This species and the last were included under the name *descripta,* Brem., in Moths of India.

1635 Pt. *A. flavirena,* Moore.

Sikhim. This also was placed under *descripta,* Brem. Four specimens in my collection seem to be referable to this. They were taken in April, May, September and December.

1636. *A. cerastioides,* Moore.

Sikhim and Bhutan, 7,000 feet. Taken in May and November. (Taken at light at Sundakphoo, 12,000 feet in July ; also from Knyvett's and Möller's collections dated May.—*H. J. E.*)

1638. *A. cervina,* Moore.

Sikhim and Bhutan. I have only one example taken by my collectors in the latter locality in December. (I also have only one of this fine species from Möller's collection dated June.—*H. J. E.*)

1640. *A. putris,* Linn.

Sikhim and Bhutan, 3,000 feet. I have taken this twice in October. (I took one only at light at Darjeeling in August, but have another marked 22·4·87 by Mr. Dudgeon.—*H. J. E.*)

Genus EPISILIA, Hübn.

1624. *E. ochracea*, Wlk.

Sikhim. I have never seen this. (Two specimens taken by Knyvett, dated 29th March 1889.—*H. J. E.*)

1625. *E. olivascens*, Hmpsn.

Sikhim. I cannot distinguish this. It is possible though that some of the insects I have marked as *Agrotis flavirena*, Moore, may be referable to it; they are, however, not sufficiently fresh to determine. (I have numerous specimens taken at Darjeeling in July, and on Tongloo it seems confined to the zone 8,000-10,000 feet.—*H. J. E.*)

1631. *E. tenuis*, Butl.

Sikhim, 5,000 feet. I have only one specimen taken at Tukvar at light in July.

E. retracta, Hmpsn.

Sikhim. This very well marked species is represented by one male in Mr. Elwes' collection obtained from Möller.

E. homochroma, Hmpsn.

Yatung. It will probably be found on this side of the passes also.

E. isochroma, Hmpsn.

Yatung. The same remark applies to this species as to the foregoing.

Genus LYCOPHOTIA, Hübn.

1629. *L. sikkima*, Moore.

Sikhim and Bhutan, 6,700 feet. I took one female at Pasheteng in October, but have not seen another. (I have seven specimens from Möller's and Knyvett's collections taken in April and May at about 7,000 feet.—*H. J. E.*)

Genus RICHIA, Grote.

1637. *R. curviplena*, Wlk.

Sikhim 2,000 to 7,000 feet. Common at Darjeeling in September and October. The apex of the forewing is distinctly produced. (By the coloration this should be an *Orthosia* as described by Walker. I have not taken it myself, so it probably is not common until late in the season.—*H. J. E.*)

Genus NEUROIS, Hmpsn.

1667. *N. nigroviridis*, Wlk.

Sikhim, 7,000 feet. I have one specimen from Darjeeling. It is probably local, as I have not taken it elsewhere. (I have six specimens of which I took two at light in August at Darjeeling.—*H. J. E.*)

1660. *N. atrovirens,* Wlk.

Sikhim and Bhutan, 6,400 feet up. I have taken this species attracted to light at Rissoom, Pasheteng and Darjeeling in June, July and September and received one specimen doubtfully marked "Yatung," 12,000 feet, through my collectors. (Very common at Darjeeling in July.—*H. J. E.*)

1668. *N. renalba,* Moore.

Sikhim, 1,800 feet up. I took this on one occasion in May at Punkabaree, but have not seen another. (Seems rarer than the last, but I took one specimen near Darjeeling and have others from Sikhim, one of which came from Kurseong, 4,500 feet.—*H. J. E.*)

Genus Eurois, Hübn.

1785. *E. virens,* Butl.

Sikhim, 6,800 feet. I have only one specimen of this procured at the electric lamps in Darjeeling in June. The subspecies *magnifica,* Moore, which is recorded from Sikhim is said to have the forewing with the inner area suffused with blood-red. My specimen seems to follow the typical *virens,* Butl. (I have four specimens of this fine insect from Möller's collection dated June and July. I never took it myself.—*H. J. E.*)

Genus Epilecta, Hübn.

1652. *E. accipiter,* Feld.

Sikhim, Yatung, 10,000 feet. I have one example with no date taken by Mr. Lister's collectors. (I have three specimens of this from the interior, probably from Möller's collection.—*H. J. E.*)

Genus Triphæna, Hübn.

1662. *T. semiherbida,* Wlk.

Sikhim and Bhutan, 5,000 feet up. Rather scarce occurring in May, June and October. (I have never taken it myself, but have four from Möller's collection taken in June and October.—*H. J. E.*)

Genus Protagrotis, Hmpsn.

1599. *P. cuprea,* Moore.

Sikhim. This was taken on one occasion by me and my only example is in the British Museum. (I have five of this distinct species in my collection, but none of them have the exact locality, and were probably from the interior.—*H. J. E.*)

Sub-family HADENINÆ.

Genus GLOTTULA, Guen.

1556. *G. dominica*, Cram.

Sikhim, 5,000 feet; Bhutan, 1,000 feet. This species has an extensive range. I reared it from larvæ taken at Tukvar feeding within the stalks of *Crinum* in August and captured it at light in the Buxar Dooars in March. I have also a specimen from Kanara in South-West India. The male has the hindwing pure white, with the exception of the apical portion of the costa, which is shaded with dark-brownish. The female has the hindwing suffused with brownish darkest towards the outer margin. The larva is described in the Moths of India. (My only specimen was reared by Mr. Dudgeon, dated 31st July 1888, but I have taken it in the Khasias in September.—*H. J. E.*)

Genus POLYTELA, Guen.

1588. *P. gloriosæ*, Fabr.

Sikhim, 1,800 feet. I took a number of larvæ at Punkabaree feeding upon *Amaryllis* and *Lilium*. They bore into the flower stems and tunnel until the same begin to wither, when they attack new ones; they also feed on the leaves. The perfect insect emerges in June, July and August from pupæ formed underground. The larva is described in the Moths of India. (I never saw this insect myself and neither Möller or Knyvett had it. It is probably confined to the Terai.—*H. J. E.*)

Genus ARCILASISA, Wlk.

1939. *A. sobria*, Wlk.

Sikhim, 4,500 feet. I have only one specimen which I took at Kurseong in October. (I have only one from Möller's collection; it must be rare in Sikhim.—*H. J. E.*)

1940. *A. plagiata*, Wlk.

Sikhim, 1,800-6,500 feet. I have taken this upon four occasions at Punkabaree and Darjeeling in June and August. It seems to be rare in these localities. (I never took this myself though I have it from Möller's collection.—*H. J. E.*)

Genus HADENA, Schrank.

1679. *H. consanguis*, Guen.

Sikhim and Bhutan, 1,000 feet up. I have taken this in January, March, April, May and November, but never during the monsoon. It is one of the commonest insects during the early part of the year at about 3,000 feet in Bhutan. (I never took this myself and have it only from Kulu.—*H. J. E.*)

1679*a*. *H. axylides*, Hmpsn.

Sikhim, 1,800 feet. I obtained one specimen of this at Punkabaree. It is now in the British Museum collection.

1680. *H. nigrocuprea*, Moore.

Sikhim. I have one specimen identified with this by Sir George Hampson. Abundant during the rains upon the Nepal frontier from Tongloo to Sundakphoo and beyond.—*H. J. E.*

1681. *H. elwesi*, Hmpsn.

Sikhim. My only example is in the British Museum collection. (I took the type of this at light near Sundakphoo, 12,000 feet, in July and have another taken at Gnatong on the eastern side of Sikhim at about the same elevation by Knyvett.—*H. J. E.*)

1684. *H. dissecta*, Wlk.

Sikhim, 5,500 feet; Bhutan, 3,000—6,400 feet. This seems a rare insect. I took one specimen at Tukvar in 1887, another at Rissoom in April 1894, and a third in November of the same year at Fagoo. (I got one only at light at Darjeeling on 20th July 1886, but have three more from Möller and two from Doherty, the last from E. Pegu.—*H. J. E.*)

1686. *H. incisa*, Moore.

Sikhim, 6,800 feet. I obtained this in Darjeeling in August. (I took one at Darjeeling in July, but have others from Möller and Gammie.—*H. J. E.*)

1687. *H. simillima*, Moore.

Sikhim. Neither Mr. Elwes nor I recognise this.

1694. *H. nigerrima*, Warr.

Sikhim. I have not seen this. (I have one specimen identified by Sir George Hampson from Sikhim ex coll. Möller, which agrees precisely with one taken at 9,000 feet in Hazara on the North-West Frontier by Johnstone.—*H. J. E.*)

1698. *H. scotochlora*, Koll.

Sikhim. I have one specimen identified by Sir George Hampson, which I took in July 1889. (I do not know this.—*H. J. E.*)

1697. *H. flavala*, Moore.

Sikhim. My only example is now in the British Museum. (Though I have never taken this myself, it must be common somewhere in Sikhim, as there were many specimens in Möller's and Knyvett's collections.—*H. J. E.*)

1698. *H. knyvetti*, Hmpsn.

Sikhim. I do not know this. (The type of this beautiful species is the only one I have seen, and it is dated 1st April 1889, by Knyvett.—*H. J. E.*)

1699. *H. albiceps*, Hmpsn.

Sikhim. This also is unknown to me. (The same remark applies to this. The type is dated 26th February 1889.—*H. J. E.)*

1701. *H. fasciculata*, Hmpsn.

Sikhim. A species of which the type is in Mr. Knyvett's collection. (Another unique specimen taken, 28th March 1889, by Mr. Knyvett. It would be interesting to know the localities for these three species.—*H. J. E.*)

1702. *H. culta*, Moore.

Bhutan. I have one specimen from this locality brought in by my collectors in June. (I have three of this species identified by Hampson from Möller, locality and date uncertain.—*H. J. E.*)

1703. *H. pannosa*, Moore.

Sikhim. This is unknown to me. (I do not know this from Sikhim, which locality rests on Moore's authority. It is well known that many species really taken by Mr. Atkinson at Calcutta and elsewhere were mixed with his Darjeeling collections.—*H. J. E.*)

Genus LEUCANIA, Ochs.

1891. *L. decissima*, Wlk.

Sikhim and Bhutan, 1,800—4,000 feet. I have taken this commonly at light at Fagoo, Punkabaree, Badamtam and Tukvar in March, April, May, June, August, September, October and November. The undersurface of the wings in the male are clothed with golden scales. (Comparatively rare at the elevation of Darjeeling, where I have only once taken it.—*H. J. E.*)

1893. *L. inframicans*, Hmpsn.

Bhutan, 2,500 feet. One specimen taken at light at Fagoo in June. The undersurface of this, a male, is heavily overlaid with silver scales.

1890*a*. *L. laniata*, Hmpsn.

Sikhim, 1,800 feet. This species of which I obtained the type male at Punkabaree has the hindwing somewhat distorted and the outer area on the underside of the same wing clothed with long downcurved dark hair. I have never taken a second example.

1894. *L. rufistrigosa*, Moore.

Sikhim, 7,000 feet. I have two specimens from Dr. Pilcher's collection taken at Darjeeling in May. (Several specimens from Knyvett's collection.—*H. J. E.*)

1895. *L. l-album*, Linn.

Sikhim. I cannot recognise this species. (I only know it from Kulu.—*H. J. E.*)

1898. *L. howra*, Moore.

Sikhim, 1,800 feet. Occurs commonly at Punkabaree in June, July, September and October, attracted to light. The blackish fascia below the median nervure on the forewing is sometimes wanting and the forewings are often suffused with a rosy tint.

1904. *L. sinuosa*, Moore.

Sikhim, 1,800 feet. I took one specimen at Punkabaree in February. (A single specimen from Möller's collection.—*H. J. E.*)

1906. *L. exempta*, Wlk.

Sikhim. I have not taken this species. It is probably rare in Sikhim. (I have two specimens only from Knyvett.—*H. J. E.*)

1907. *L. v-album*, Hmpsn.

Bhutan, 3,000 feet. I took this on one occasion at Fagoo in June.

1910. *L. modesta*, Moore.

Sikhim. I have only taken this upon one occasion, and my only example is now in the British Museum. (I found this not uncommon at light on Tonglu in July.—*H. J. E.*)

1911. *L. loreyi*, Dup.

Sikhim, 1,800 feet. Rare at Punkabaree in May, June and September.

1913. *L. unipuncta*, Haw.

Sikhim and Bhutan, 1,800 feet up. Common throughout the rains and hot season. I have specimens taken in every month from April to September. (I took this at Mongpoo about 3,500 feet, but never at Darjeeling.—*H. J. E.*)

1914. *L. pallidicosta*, Hmpsn.

Sikhim. I have not taken this. (I have two distinct looking specie under this name in my collection from Sikhim, one of which forms Atkinson's collection, which is *albicosta*, Moore, is larger and redder than the other.—*H. J. E.*)

1919. *L. cinnamomea*, Moore.

Sikhim. Occurs in Darjeeling in December and probably in other months. (A single specimen named by Sir George Hampson is unlike a *Leucania* in markings. I think the Indian species of this genus require further study.—*H. J. E.*)

1920. *L. nigrorenalis*, Hmpsn.

Sikhim. I have not received this. (This again is unlike a *Leucania* superficially ; the only specimen was taken by Knyvett on 1st February 1889.—*H. J. E.*)

1921. *L. distincta*, Moore.

Sikhim. I have not taken this. (Two specimens from Möller's collection, dated 9th October 1888, are very distinct from anything else I know from Sikhim.—*H. J. E.*)

1922. *L. obscura*, Moore.

Sikhim and Bhutan, 3,000 feet. I have taken this attracted to light in July and October. It is not common. (I have only one from Atkinson's collection.—*H. J. E.*)

1924. *L. reversa*, Moore.

Sikhim and Bhutan, 6,700 feet. I have only one taken at light at Pashoteng (I never saw it from Sikhim, but it is common in the Naga Hills.—*H. J. E.*)

1925. *L. fasciata*, Moore.

Sikhim. I have not taken this. (A single example identified by Sir George Hampson from Möller.—*H. J. E.*)

1928. *L. albicosta*, Moore.

Sikhim, 1,800 feet ; Bhutan, 3,000 feet. Common at Punkabaree at light. My Bhutan specimen does not quite agree with the Sikhim ones, being longer in the wing and with the white streak on the median nervure not turned upwards along the lower discocellular nervule. All my specimens were taken in February and March. (Judging from the specimens I have from the Khasia and Naga Hills there are more than one species placed under this name by Sir George Hampson. —*H. J. E.*)

1929. *L. curvilinea*, Hmpsn.

Sikhim, 1,900 feet. One specimen taken at light in June identified by Sir George Hampson.

1930. *L. venalba*, Moore.

Sikhim, 1,800 feet. Occurs in May and June, but not commonly.

1934. *L. irrorata*, Moore.

Sikhim and Bhutan, 1,800—3,000 feet. Occurs but not commonly in May, June and July. (I only have this from the North-West Himalayas.—*H. J. E.*)

THE ORIGIN OF THE ENGLISH NAMES OF PLANTS.

By the late Thomas Comber, F.L.S., written about the year 1880 but never published.

(Read before the Bombay Natural History Society by E. Comber, F.Z.S., on 21st January, 1904.)

The paper that I submit for your acceptance this evening is on "Plant names"; and when I selected my subject, and fixed upon this title, I could not help fancying that many of you, when you read the announcement, would say to yourselves—or if you did not say it you would think it—"what a very uninviting subject"; and that you would thereupon prepare yourselves for a very dry discourse. Not long ago I was urging on a young lady to take up the study of botany, and expatiated on the pleasures she would certainly derive from it; when in reply she assured me that she liked it extremely and would take it up "were it not for those horrid names". I fear she is a type of a good many who are fond of flowers, and have felt more than half inclined to enter on botanical studies, but have been deterred by the hard names that have been given to plants. Encountering these at the outset, and not having had time to become familiar with them, they turn away from botany, and come, perhaps reluctantly, to the conclusion that the game is not worth the candle. Some of you may anticipate that I am about to treat of these repulsive crack-jaw names, and that you will thus have the most disagreeable part of botany, without any of its redeeming features. Let me remark, in the first place, that, uninviting as these long names may appear when we first meet with them, they improve vastly upon acquaintance, and become at last "familiar in our mouths as household words". For instance, people now talk almost as glibly of a rhododendron or a chrysanthemum as they do of a lily or a rose, and this, too, without knowing the meaning that the former names express, for few stop to consider that rhododendron means a rosy tree, and chrysanthemum a golden flower; and that the names were given to the plants in allusion to the colour of the flowers of the varieties that were first introduced into our gardens. If once we understand the meaning of such names they lose much of their disagreeable sound. In the second place, I must tell you that it is not at all of these so-called scientific names that I wish to speak, but of the popular names which we learnt as children, and have used all our lives. I propose that we should enquire into their origin, and try to ascertain when, how, and why, and also, if possible, where and by whom a beech tree came to be called beech; a cabbage, cabbage, and wheat, wheat. Before entering on the special subject I should like to say a few words upon names in general. A name, as we now use it, is simply a conventional term whereby we indicate to others the particular object to which by long usage it has been applied; but, if we can succeed in tracing it back to its origin, we shall find that it had at first not a conventional but an expressive meaning, and that the meaning it expressed was, in one way or other, descriptive of some peculiarity which served to distinguish the object to which it was applied from other objects. Some names of recent origin have not yet passed, or are only just passing, from the descriptive into the conventional stage. Thus "India-rubber", though we use it now conventionally for the well-known elastic substance, has not yet lost its expressive character, and still seems to remind us that the substance came, or was supposed to come, from the Indies, and that it is used to rub out pencil marks. Sooner or later names lose their expressive character either by the slow change of language in the long course of time, or, more rapidly, by passage from one language to another. For example, when we talk of "roast beef" or a "bull-dog", we use terms that are to us expressive and describe beef cooked in a particular way, and a dog of a breed formerly kept for baiting bulls: but when these terms pass into French, as "rosbif" and "buldogue" they entirely lose their descriptive meaning; and, although still applied to the same objects, they become purely conventional. It is one of the most interesting of studies thus to trace back a name, and hunt it from one language to another, until at last we run it aground in its original starting place, and ascertain what it originally expressed when it first came into existence. Of course very old words, close down to the foundations of language, have their origin in very elementary roots; but even so we can frequently arrive at the primary idea that they were intended to convey. Thus, when we find that the word "man" springs from a root that means to think, we can readily understand that our early forefathers fixed upon the reasoning powers of the human race as the best distinction whereby to separate it from the brute creation; and, regarding man as preëminently the thinking animal, they adopted as his designation a name which expressed the attribute of thought, and called him the "thinker". In thus investigating the origin of names we not only recover the history of the name itself, but often ascertain also interesting facts respecting the object which it indicates. As an example of one mode in which a name can become a historical record I would refer to a place in Cumberland known as Torpenhowe Hill. The hill stands, I believe, in quite an isolated position, and forms such a very marked feature in the landscape, that the inhabitants of the immediate neighbourhood would be quite justified in terming it the hill ; there is no other thereabouts. Such was, at any rate, the name given to it by a Celtic tribe which at one time occupied that part of the country, for " tor " means a hill or eminence and still conveys that meaning in Devon and Cornwall, the tors of Dartmoor being well known. These Celts were in time succeeded by others, who spoke a somewhat different dialect, and to whom the term " tor " as designating the hill was not descriptive. They did not understand its meaning ; and, as it was to them merely a conventional term for the locality, or as we should say a proper name, they added to it the word which meant a hill in their dialect, *viz.*, " pen ", a component part of the names of many of the Welsh hills, *e.g.*, Pen-maen-maur, and called the place "tor-pen ". Later on the country was occupied by the Danes, by whom " torpen " was regarded as merely a proper name ; and, ignorant of its meaning, they added to it their own word for hill, *viz.*, " howe " and it became " torpen-howe ". After them came the Saxons, to whom " howe " conveyed as little meaning as ' tor ', or ' pen ', and therefore to the Danish name, as they found it, they affixed their own word ' hill ', making it " Torpenhowe-hill ". So it stands for the present, the name thus meaning in reality hill-hill-hill-hill. Fortunately the Normans let it remain, and we are spared from having to call the place " Torpenhowe hill-mount ". You will see that the name contains within itself the record of four successive occupations of that part of the country ; and we require no other to tell us that Cumberland has been overrun in turn by Celt, Dane and Saxon. There is another method by which a name can be made to disclose something beyond its own history, *viz.*, by comparing it with its forms in other cognate languages, and ascertaining in how many it exists as a native word. The forms are often very unlike each other ; but there are certain etymological rules which enable us to affirm with confidence the identity of words bearing so little outward resemblance as our own " five" and the French " cinq".

Now, when we find two words thus etymologically identical conveying the same meaning in different languages, we may safely conclude that the object which they signify was known to the ancestors of the nations speaking those languages, before they separated from each other. As an example let me cite our word "*ox*". It exists in this form in English, as "*ukshan*" in Sanscrit, in the feminine "*vacca*", a cow, in Latin, and in various other forms in many other European and Asiatic languages. As it is always applied to cattle, we may feel certain that before our forefathers and those of our Hindoo fellow-subjects separated from each other, cattle were known to them, and had received a distinctive apellation. But we can go further, and assert that the cattle had been domesticated, and were used for purposes of draught; for the word comes from a root signifying to draw, which is found in the Latin verb "*veho*", whence our word "*vehicle*"; and this title can only have been given to an animal from its being used for the purpose named. The word "*ox*" therefore suffices to assure us that the Indo-European, or as it is otherwise called the Arian, race, before it scattered south and west from its cradle in Central Asia, had attained such a degree of civilization as is implied by the domestication of animals. Let us take another word, "*mead*" meaning honey-wine. It originates in a root meaning primarily to be demented or insane, whence our word "*mad*", but it was also applied to that temporary form of insanity produced by the excessive use of alcoholic liquors; and finally, apparently because the condition of drunkenness was regarded as one of complete felicity, the verb came to mean to be happy. "*Mead*" comes from the root in its second signification, and means an intoxicating drink in several languages both of Europe and Asia, showing us that the Arians were by no means total abstainers. But the word has often also the alternative meaning of "honey", and we may further infer that the old Arians used a stimulant which, like the "mead" that was such a favourite tipple with our Anglo-Saxon fore fathers, was made from fermented honey.

From words like these which are common to Europe and Asia, and must therefore have existed, in some form or other, in the original Arian language, much has been learned respecting these remote prehistoric ancestors of ours, their mode of life, domestic relations, arts, government, and religious belief. But there are many more words that are found only in the different families of language that are spoken in Europe; and these are presumably of more recent origin, and have come into use after the great split which seems to have taken place in the Arian tribes, of whom part spread southward in Asia and occupied Persia and India, while others migrated to the West and occupied Europe. In doing so they drove back or exterminated the former inhabitants, of whom only scattered remnants are now found, speaking languages entirely different from the Arian ones, such as the Magyars of Hungary, the Laplanders, Finns, and the curious tribe on shores of the Bay of Biscay. Other words, again, are still less ancient, and seem to have come into use when there had taken place a further subdivision of the Arian tribes in Europe ; for they are found only in a particular family of languages, such as the Teutonic, Sclavonic, or Romance ; so that we may conclude that they originated after the Teutons had separated from the Sclavs, and both from the Latin race. Next we have words which are not found even in other languages of the same family as our own, such as German, Dutch or Danish, but are confined to our own Anglo-Saxon tongue ; and these are evidently of comparatively recent date, springing up after the Anglo-Saxons had separated from their relatives on the Continent. Last of all come words which we have borrowed from other languages, mostly from the Latin, either directly or more frequently through the French, these last having come in with the Normans at the time of the conquest, and been gradually incorporated in that highly compound production which we speak of as the English language. We see, then, that our mother tongue consists of many successive strata, some very much older than others ; and just as geologists from the study of the fossils that are found in the different strata of the earth's crust have been able to construct a history of the progressive development of life upon our globe, so philologists, by separating languages into their different strata, are now building up a history of the early tribes from which the greater part of the present population of Europe, and not inconsiderable part of that of Asia, are descended.

I have entered into this long digression because our plant names exhibit a like stratification to that of our language in general. We have a few native plant names that are found in use in both portions of the Arian district ; about an equal number are indigenous in several of the European families of language, considerably more are Teutonic. Some, again, are Anglo-Saxon or English, but by far the greatest majority are borrowed from other languages ; and many of these last, although they may be of great antiquity in their original language, are quite recent as English words, having been introduced within the last 200 or 300 years. It will perhaps be most convenient if I take each class of name in its chronological order and give you specimens as I go along: for it is, of course, impossible to attempt in a single paper to explain all our names, and I must be content with citing only a few typical examples.

Let us take first a name which has been familiar to us in our earliest childhood, and was in the school days of many of us a name of dread, although I believe it no longer awakens in the mind of the boy of the period associations of a like painful nature. I mean the *birch*, or as it is called north of the Tweed, the *birk*. This tree is still known by the same name on the slopes of the Himalayas as on the shores of the Atlantic, the present Hindustani form being *bhurja*, and the name is found, with only slight variations, in all the languages of Northern Europe, whether Teutonic, Sclavonic, or Celtic. It has reference, like most tree names, to what was the most useful product of the tree, namely its bark, which is to this day used by many savage or half-civilized tribes for a variety of purposes, amongst others for roofing houses and making greaves or mocassins to protect the legs. Now bark is that which surrounds and protects a tree, and the word comes from a verb meaning to protect or shelter (in German *bergen*), from whence come also our words *borough* or *burg*, meaning originally a town surrounded and protected by walls, and *park*, a tract of land enclosed by palings. Birch bark being the sort most used, the tree came to be regarded as prëeminently the bark tree, and was so called. We may therefore be sure that the old Arians used the material formerly, as the North American Indians do still. One of the chief purposes for which the Indians use birch bark is for making their canoes; and our Teutonic ancestors evidently at one time used it in like manner, for they called the vessels so made by the name of the material, as testified by our words "bark" and "barge", and similar ones, with the same meaning, in many European languages.

On the fact that the present natives of India and the people of Northern Europe call the birch by the same name, has been based an argument that their common ancestors must have inhabited a northern clime; for the birch is more particularly a northern tree; and it is contended that when the Brahminical race invaded India, this was the only tree they recognised, all the others being strange to them. But the birch is not the only tree that bears a name common to Europe and Asia. We find a second in the *willow*, whether with respect to this name, now most commonly applied to it in England, or to the term *withey*, which was the more frequent name in Anglo-Saxon times. Both names have reference to the use of the twigs for wicker work, the former having its origin in a root meaning to twist or turn round, found also in our verbs *wheel* and *walze*, the latter from one meaning to weave; and thus both testify that the Arians, before the Indian and European branches of the race separated from each other, used willow twigs for wicker. The initial letter of "willow" varies in different languages, either to S., as in the Latin *salix*, or to an aspirate, as in the Greek *helix*; and through the former the name comes into English in the modified form of *sallow*. This change of initial guides us to a connection between the tree-name and our words "*hall*" and "*saloon*", the latter a derivative, through "*salon*" of the French "*salle*". Chaucer writes :—

> "Whoso that bildeth his hous all of salwes,
> And pricketh his blind hors over the falwes,
> Is worthy to be honged on the galwes."

The style of building alluded to is that known in Cheshire as 'wattle and daub', and consists of a framework of rods, with twigs interwoven, so as to make a kind of rude wicker, the interstices of which are filled up with a daubing of clay. It is of ancient date, for there is, I believe, evidence that the ancient lake dwellings of Switzerland were thus made, and apparently the Arians of Europe used willow twigs for the purpose, and called their edifices by the name of the material, so that the old forms of 'hall' and 'salle' came to mean a house. The words had also the alternative meaning of a stall, and thus, as Dr. Prior observes, seem to tell us "that our ancestors dwelt in houses of wicker "work, even men of rank. In fact, the royal sheepcote was in the "primitive nation the royal palace, as among the Tartars of the interior "of Asia is the 'aoul' of the present day".

Among the plant names which belong to the earliest Arian period may be reckoned '*barley*', or rather the first portion of that name. The latter syllable "*ley*" is merely an adjunct, the equivalent of "*leek*", which in Anglo-Saxon times meant herb or plant, and is found, in such names as house-*leek*, char-*lock*, hem-*lock*, appertaining to plants that in no way resemble the vegetable, dear to Welshmen, to which we now confine the name. The first syllable "*bar*" is the essential part, and is still used by itself in Scotland, in the slightly altered form '*bear*". It comes from the same root as our verb 'to bear', in its sense of "to sustain": thus *bar-ley* is the sustaining plant, or plant that sustains life. Corresponding words, from the same root, are found in various languages of both Asia and Europe; but they are applied to very different grains. In Latin, for instance, '*far*' meant spelt, while a newly related word, *farina*, meant flour. We should therefore be unable to infer that barley was cultivated by the early Arians were it not that the special names of this grain in Persian, Latin and German are etymologically identifiable. In the primitive Arian language the name corresponding to 'bar' was probably generic, and signified any kind of cereal; and the different branches of the race have, after their separation, confined it specially to different grains. Such specialisations are frequent, and one is now going on in America, where our word 'corn' has lost the meaning that it has in England, of grain in general, and is confined to the maize or Indian corn.

Bean is our representative of another primitive word, coming from a root signifying "to eat". The plant bears corresponding titles in Persian and in nearly all European languages.

The second class of names with which we have to deal is of those which exist as native words in several families of language in Europe, but do not extend into Asia. They must have been in use at the time when the European branch of the Arians had not split up to into different sections. Perhaps the most interesting of them is '*beech*', a descendant of an old Gothic *boka*. It comes from the same root as 'bean' already referred to as meaning 'to eat', runs through all the Sclavonic, Teutonic and Celtic languages, and is etymologically identical with the Latin *fagus* and Greek *phegos*. In Greek the name appertains to an oak which produces an edible acorn, and we can see the reasonableness of the title; but in other languages it is applied to the beech; and as its fruit or 'mast' can hardly be regarded as eatable by man, the name must have reference to its serving as food for cattle. The tree, like the birch and the willow, has bestowed its name on that which was made from it, and gives rise to the name for 'book' in all Teutonic tongues. The Latin and Greek names for book both come from the material used for writing on; and it is clear that tablets of beechwood were first used for this purpose by the Teutonic tribes.

In German, " buch-stab ", equivalent to " beech-stave ", still means a letter, and the old runic tablets are found to be made of this wood.

Fir is another tree-name native both to the North and South of Europe. *Fir*-tree is equivalent to *fire*-tree, the wood, from its resinous nature, being exceedingly inflammable ; but its Latin form *quercus* is applied not to the fir but to the oak. We see, then, that the Teutonic name for fir means in Latin an oak ; while the Greek name for oak means in the Latin and Teutonic tongues a beech ; and, in connection with this change of meaning, Prof. Max. Müller has pointed out that the remains of trees in the peat-bogs of Denmark show that at one time the fir was the prevailing tree in that part of Europe, but that later on it was succeeded by the oak, and more recently still by the beech. He considers that these facts go some way towards proving that Arian languages were spoken in Europe as far back in geological time as when the fir was still the predominant tree in Denmark, and that the transfer of name from one tree to another took place as each became the more common. This view has been strongly combated by other professors, and as doctors disagree, I suppose we disciples are free to form our own opinions. To me it seems more probable that the names were at first generic, the predecessor of beech meaning any forest tree producing food for man or cattle, and the predecessor of fir any suitable for firewood, but that the names were subsequently specialised to different trees by different branches of the Arian race.

Our word *oat* appears to have been in its earliest stages in like manner a generic term, and to have included, as its Welsh equivalent " *yd* " still does, any description of grain : but the Anglo-Saxons specialised it to the particular kind of corn that we now know by the name, while the Romans applied it, as *ador*, to spelt, said by Latin authors to have been the earliest food of their nation. It is derived from a root which exists in our word "eat "; and Dr. Prior points out that the word seems to have originally meant " food."

Coming next to names native in various Teutonic languages, but not extending to other families of language, the first example I would cite is " *wheat* ". As this grain bears a name etymologically distinct in each of the families of Arian languages, the inference is that it was not, like barley, in cultivation before the primitive nation had broken up, but was acquired by the different sections after they had separated from each other. The acquisition must, however, have taken place before the various tribes of Teutons had parted asunder, for in each of their languages it bears a cognate name, which originally meant "white". They evidently so called the grain to distinguish it from rye, black oats, and other dark-coloured corns with which they had previously been acquainted, and this is supported by the Welsh name, which, although not etymologically identical, expresses exactly the same idea – "*gwenith*" being a compound of "gwen" white, and "*yd*" corn.

Another interesting word common to several Teutonic languages is represented in English by "*hawthorn*", that is, the tree used for "haws", "hags", or as we now call them, "hedges": and it bears testimony, more reliable than the assertion of Cæsar to the contrary, that our Teuton forefathers had attained at a very early date to a sufficient civilization to appropriate plots of ground as private property; when, for the fences with which they marked their boundaries, they used this plant, as we do still.

The *nettle* bears a name which should be of special interest to ladies, for it relates to what was, I fancy, even in those early Teutonic times, the feminine department of our ancestors' household arrangements. It comes from a root "*ne*", meaning in most of the Arian languages to spin or sew, from whence also comes our word "needle". You will perhaps wonder what the nettle can have had to do with sewing, but the fact is that it supplied the thread. Flax and hemp were originally southern plants, and bear southern names, but long before they were introduced, the hardy nettle supplied the inhabitants of Northern Europe with the fibre which they used for spinning. It remained in use until quite recent times, for not long ago English maidens were not, in some parts of the country, considered to have qualified themselves for matrimony until they had spun and woven for themselves a supply of nettle house-linen. An experiment is now being made in Germany to revive the cultivation of this plant for textile purposes.

Let us proceed now to names found only in our own language. We shall find that, having had less time to change from their original expressive form, their meaning is often more easily discovered than is the case with older names; but yet they vary much in this respect. Some still quite new, such as "Blue-Bell" and "Sun-flower", speak at once for themselves; but those that go back to Anglo-Saxon times are sometimes composed of words now fallen into disuse, and have thus either altogether lost their expressive meaning, or else convey one that is misleading. *Marigold*, another Anglo-Saxon name, has experienced a like change of application, and is of rather complex origin. The last syllable "gold" was a title given formerly to many different kinds of yellow flowers, in reference to their colour; and the Anglo-Saxon word "mear", or as we now write it "mare", meaning a horse, was prefixed to distinguish one of these flowers of large coarse growth, namely that which we now term the marsh marigold. The placing of the word "horse" before a plant-name, to signify coarseness of growth or flavour, is not uncommon, for we speak of horse-mint, horse-chestnut, horse-radish, &c., and the Greeks used their word for horse in a similar way. In course of time the English "mare-gold" came to be misunderstood as "mary-gold," and was transferred to the garden plant that now bears the title.

Even words which cannot be traced back to the Anglo-Saxon vocabularies and are therefore presumably of later or English origin, sometimes, through corruption of mispronunciation, no longer convey their original expressive meaning. Thus "*bulrush*" is a corruption of "*pool*-rush"; and "*carnation*" has no reference, as some suppose, to the flower being often of a flesh colour, but was originally written "*coronation*", and the flower took this title from having been much used for making chaplets and garlands.

Many names of English origin express the medical properties which the plants possess, or were supposed to possess at the time when herbs constituted nearly the whole of the pharmacopœia. In their administration the doctors or leeches of the age were guided by what was known as the doctrine of signatures, based on the belief that each plant bore an outward sign declaring to any careful observer the disease for which it was a medicine. The spotted leaves of one plant showed that it was a sure remedy for spotted or tuberculous lungs, and it was called the *lungwort;* the lobed leaves of a fern resemble the spleen in shape, and it was therefore held to be good for all diseases of the spleen, and was named *spleenwort;* and a Canterbury bell, which has the throat of its flowers rough with hairs, was considered infallible for roughness or hoarseness of the throat, and was consequently known as "*throatwort.*"

All the names we have so far treated of are genuine natives, and have originated in some stage or other of our own mother-tongue; but we must now pass to names which have been adopted from foreign languages, and, although now thoroughly incorporated with our own, are in reality only naturalized. This appropriation of alien names has long been going on, at any rate from the time when the Teutonic settlers came into contact with Roman civilization, and adopted the Latin names for such vegetable productions as were then introduced to them. We thus find in the Anglo-Saxon vocabularies borrowed names for many cultivated plants, such as the pear and the plum, fennel and mint, the lily and the rose.

At the time of the conquest there was a great accession of foreign names, brought in by the Normans; and since then, as fresh plants have come into cultivation they have often carried into our English language fresh names, being modifications, more or less corrupt, of those which they bore in the country from whence they were brought to us. To show the great variety of languages from which we have borrowed, I will give a few examples of each.

A great number of our names are of *Greek* origin. They have come to us not directly, but through the Latin, and generally also through French. *Thyme* is little changed from the Greek *thumos,* which came from *thew,* I fumigate, and was applied to fragrant herb much used as incense in sacrificial offerings. A large proportion of the Greek plant names are connected with the names of places, and indicate from whence the plant was introduced to the Greeks. Thus *peach* was in its earliest stage *melon persikon,* meaning persian apple; *cherry* takes its name from a town of Asia Minor; *chestnut* from a city of Thessaly; *carraway* seeds from Caria; and *cypress* from the island so recently added to the British dominions. How the names of places came to be thus attached to plants we can readily understand, for we have plenty of instances in our own language. A grocer will supply us with *currants, i.e., Corinth* raisins; farmers talk familiarly of their crop of *Swedes*; whilst a market woman will assure us that some of her apples are real *Ribstons,* or *Blenheims,* or *Newtowns.*

It is from the Latin wherein these Greek names were as much aliens as in our own language, that they have come down to us; but we have also received from it many names that are of genuinely Latin origin. *Vetch,* or as it was formerly often spelt *fytch,* is a corruption of the Latin *vicia,* and comes from a verb signifying to bind, with reference to the manner in which this plant binds together by its tendrils the herbage over which it creeps. It was thus exactly equivalent in meaning to our English "*bindweed*", a name appertaining to the convolvulus, which has a similar habit of growth. *Lettuce* is descended from the Latin "*lactuca*", a name descriptive of the milky juice of this vegetable; while *pisum*, the predecessor of our *pease*, meant something that had been shelled or freed from its husks. When the latter name passed into our language it signified a single seed; and people talked of *a* peaso in just the same manner as they did of *a* bean. Its plural was formed, like "oxen" and "hosen", by adding "n", *viz.*, *peasen*, or as it was sometimes written *peason*. This plural form survived in rustic dialects until quite recently, being used by such folk as the old farmer, who

> "......talked of turmets and of *peason*"
> "And several good seed in proper season."

More generally *pease* came, in course of time, to be regarded as itself the plural, and a singular was formed for it in our present *pea*. Some of our names from the Latin have, like so many of those from the Greek, reference to places; as, for instance, "damson", a corruption of "prunum *damascena*" or "Damascus plum".

French, besides serving as the channel whereby most of the Greek and Latin names have come to us, has given us also many of its own. You will at once think of "*mignonette*", meaning "little darling"; and of "*pansy*", which is merely the French *pensée*, a thought, as Shakespeare writes: "There is *pansies*, that for thoughts;" but equally French is "*dandelion*", otherwise "dent de lion" or lion's tooth, so called probably from the tooth-like cutting of the leaf; and "*eglantine*", &c., as Chaucer and the old poets write it, *eglantere*, which is a corruption of the French "*aiglentier*", from *aiglent*, covered with prickles. *Mushroom* is the French *mouscheron*, from mousche, a fly; and the name appears to have been given first to a poisonous species of fungus, formerly used for killing flies, then extended to a generic term, and lastly specialised to the edible species to which it now appertains. The "*William*" of "Sweet William" shows in its present form no sign of being French; but it comes from "œillet," literally little eye, the French generic name for pink, which was anglicised as "Willy" and thence passed into "William".

Italian has given us several names; amongst them *cabbage*, which represents the Italian *cabuccio*, a diminutive formed from *cabo*, a head, and applied to the vegetable, evidently in allusion to its round head-like shape. The earliest form of *primrose* was the Italian "*fior de prima vera*", or "flower of first spring", which was shortened into "*prima* *vera*", and gave rise to a diminutive "*primaverola*". This passed through French into English as "*prime-rolles*," in which form the name appears in MSS. and the earliest herbal, and has since been modified into the present name. The *Jerusalem* artichoke we might imagine from its name to have come to us from the Holy Land; and with some such idea our cooks call the soup made from it "Palestine" soup; but, in reality, it is a sun-flower, brought originally from America; and its title "Jerusalem" is merely a corruption of the Italian *girasole*, meaning that which turns to the sun. The name thus expresses the peculiarity attributed to the flower, which Moore refers to in the lines

> "As the sunflower turns to her god in the West
> "The same look which she gave when he rose."

From languages more closely related to our own, we have not borrowed very many names, for many of their names are native also with us. From the *German*, however, we get *snowdrop*, the "drop" referring "not to icicles, but to the large pendants or drops that were worn by the ladies of the 16th and 17th centuries both as earrings and hanging to their brooches." From the *Dutch* we have *gooseberry*, the first syllable of which is a corruption of the Dutch word for "cross", and describes the peculiar spines of the bush, three of which spring from the same spot, at right angles to each other, so as to form a cross.

Considering that at one time our country was inhabited altogether by Celts, and Celtic dialects alone must have been spoken in it, it is somewhat strange how few Celtic words survive in the English of the present day, except in the names of localities. We can only infer that the Celts did not amalgamate with their conquerors, but retired before them, carrying their language with them to the districts, where it still survives in Welsh, Gaelic and Irish, and until quite recently also in Manse and Cornish. Our plant-names show the same absence of a Celtic element; but the *maple* bears a title derived from the Welsh *mapwl*, a knob, and referring to the knotty excrescence in the trunk of this tree, which was at one time very highly prized for the ornamental wood it yields. Strange to say, although the name was adopted by the Anglo-Saxons, it does not survive in the Welsh of the present time. *Ozier* probably originates from a Celtic word signifying water, whence the name of the river *Ouse* and of a liquid possibly known to some of you termed *whisky*: but the name *ozier* has come to us since the Norman conquest, from the

French rather than direct from our Celtic neighbours; and almost the only name we have borrowed from them is *shamrock*, meaning literally little trefoil.

It only remains for us now to go further abroad, and enquire which of our names have originated in languages spoken out of Europe. Some of our favourite flowering plants have evidently been brought from Persian gardens, for they bear Persian names, such as *jasmine* ; *lilac*, which has reference to the bluish colour of the flower ; and *tulip*, which is derived from the Persian word meaning turban ; and anyone who has seen in an Eastern bazaar the rich effect produced by the gaily-coloured head-dresses of the natives, will recognise at once the force of the simile which led to such a name being given to this rather gaudily-tinted flower. The names *orange* and *lemon* bear witness in like manner to the native countries of those fruits, for they start originally from India. The latter comes from a root meaning "to eat", the former from two Sanscrit words meaning 'tree' and 'colour', and this name was doubtless given to the tree in allusion to the distinctive colour of the fruit, which has led, in comparatively recent times, to the name of the fruit being given to the colour.

The earliest form of the name *sycamore* is probably found in the Hebrew *sikemah*, whence it has passed to us through Greek, Latin and French, changing, however, its application during the journey. The Hebrew, Greek and Latin names indicate an entirely different tree from that to which the title pertains in French and English, namely, a kind of fig, and it was up this tree that Zaccheus climbed.

Turning lastly from the East to the West, we find that, since the discovery of the New World, we have received some few names from across the Atlantic, such as *tomato*, *potato*, *tobacco*, and *maize* : but enough is not known of the Indian languages spoken in the parts of America in which these names originated to enable us to ascertain their primary descriptive meaning.

With these American names I must now bring my long catalogue to a close—not from any paucity of other names quite equal in interest to those I have cited, but from a regard for your patience, which indeed I fear may have been already overtried. I hope I may not have exhausted it, and wearied you by entering too much into detail: but you will doubtless have seen that the subject is one which cannot be treated of only generally. It requires considerable detail to explain and sufficient examples to illustrate it. My object has been to show that our plant names are not mere sounds, expressing only conventionally the meaning which they now possess, but that they are living symbols, which have grown into their present significance ; and that consequently each carries with it a story, if we can but read it aright, and, further, that the interest of the story is at times enhanced by the fact that it reveals to us circumstances respecting our forefathers of which we can have no other record, for they belong to a period preceding even the earliest dawn of history.

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THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES III. PART I.

BY SIR G. F. HAMPSON, BART., F.Z.S., F.E.S.

(*With Plate D.*)

EUPTEROTIDÆ.

85. NISAGA SIMPLEX.

♀. Uniform dull reddish brown.

Family SPHINGIDÆ.

The *Sphingidæ* having lately been most carefully classified by the Hon. W. Rothschild and Dr. Jordan in supplementary volumes of the Novitates Zoologicæ, an epitome of the classification of the Indian species will be useful to students of the Moths of India.

Key to the Sub-families.

- A. First joint of palpus without patch of short sensory hairs on inner surface near base.
  - *a.* Terminal joint of antenna long and thin with long hairs and bristles, (1) .... *Acherontianæ.*
  - *b.* Terminal joint of antennæ short, (2) .... *Ambulicinæ.*
- B. First joint of palpus with patch of short sensory hair on inner surface near base.
  - *a* Pilifer normal (3).
    - a^1. Abdomen with the tenth segment mesially divided. *Sesianæ.*
    - b^1. Abdomen with the tenth segment not mesially divided .... *Macrogolssinæ.*
  - *b.* Pilifer consisting of a terminal part bearing short, or vestigial, bristles and a proximal part bearing long bristles .... *Pergesinæ.*

(1) *Dolbinopsis* and *Dolbina* have the terminal joint of antenna short, but may be distinguished from the *Ambulicinæ* by the evenly curved termen of forewing.

(2) *Compsogene*, *Oxyambulyx* and *Cypa* have the terminal joint of antenna long, but may be distinguished from the *Acherontianæ* by the Ambulicine shape of the apex or termen of forewing.

(3) The pilifer is the small curved organ bearing a comb of bristles above the base of proboscis.

Sub-family ACHERONTIANÆ.

Key to the Genera.

- A. Terminal joint of antenna long and thin with long scales and bristles.
  - *a.* Palpus with the 2nd joint excavated on inner side, the cavity covered by long scales.
    - a^1. Proboscis shorter than thorax .... *Acherontia.*
    - b^1. Proboscis longer than body.
      - a^2. Palpus with large apical cavity formed by the scaling on outer side of 1st joint .... *Megacorma.*
      - b^2. Palpus with the scaling normal .... *Herse.*

b. Palpus with the 2nd joint not excavated on inner side.
  *a*¹. Pulvillus present.
    *a*². Fore tibia with spines .... *Thamnoecha.*
    *b*². Fore tibia without spines.
      *a*³. Paronychium with two lobes on each side.... *Meganoton.*
      *b*³. Paronychium with one lobe on each side...... *Psilogramma.*
  *b*¹. Pulvillus absent or reduced to a short triangular lobe.
    *a*². Forewing more than 50 mill. long .... *Apocalypsis.*
    *b*². Forewing less than 40 mill. long .... *Pseudodolbina.*
B. Terminal joint of antenna short.
  a. Fore tibia with apical claw ; pulvillus absent........... *Dolbinopsis.*
  b. Fore tibia without claw ; pulvillus present............... *Dolbina.*

Genus Herse.

[illegible]

„ *alicea*, Neuburg, Zeitschr. Ent., IV. p. 297 (1899).
„ *nigricans*, Cannaviello, Butl. Soc. Ent. Stal., XXXII. p. 295 (1900).
Habitat.—Eastern Hemisphere, except the higher latitudes.

Genus Megacorma.

	Type.
Megacorma, Roths. Nov. Zool., IX, Suppl., p. 15 (1903)	*obliqua.*

163*a*. Megacorma obliqua.

Macrosila obliqua, Wlk., VIII. 208 (1856).

Sphinx nestor, Boisd. Spec. Gén. Lép. Hét., I., p. 113 (1875).

Habitat.—N. India ; Ceylon ; Burma ; Sumatra ; Java ; New Britain.

Genus Acherontia.

	Type.
Acherontia, Lasp. Jenaische Allg. Lit. Zeit., IV. p. 99 (1809)..	*atropos.*
Atropos, Oken, Lehrb. Naturg., III. p. 762 (1815)	*atropos.*
Brachyglossa, Boisd. Ind. Meth., p. 33 (1829)................	*atropos.*

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Eupterotidæ.

85. Nisaga simplex.

♀. Uniform dull reddish brown.

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The *Sphingidæ* having lately been most carefully classified by the Hon. W. Rothschild and Dr. Jordan in supplementary volumes of the Novitates Zoologicæ, an epitome of the classification of the Indian species will be useful to students of the Moths of India.

Plate D, herein referred to, will appear in a subsequent number of the Journal.

EDITORS.

b. Pilifer consisting of a terminal part bearing
vestigial, bristles and a proximal part bearing long
bristles.. *Pergesinæ.*

(1) *Dolbinopsis* and *Dolbina* have the terminal joint of antenna short, but may be distinguished from the *Ambulicinæ* by the evenly curved termen of forewing.

(2) *Compsogene*, *Oxyambulyx* and *Cypa* have the terminal joint of antenna long, but may be distinguished from the *Acherontianæ* by the Ambulicine shape of the apex or termen of forewing.

(3) The pilifer is the small curved organ bearing a comb of bristles above the base of proboscis.

Sub-family Acherontianæ.

Key to the Genera.

A. Terminal joint of antenna long and thin with long scales and bristles.
  a. Palpus with the 2nd joint excavated on inner side, the cavity covered by long scales.
    *a*¹. Proboscis shorter than thorax .... *Acherontia.*
    *b*¹. Proboscis longer than body.
      *a*². Palpus with large apical cavity formed by the scaling on outer side of 1st joint.................. *Megacorma.*
      *b*². Palpus with the scaling normal .... *Herse.*

b. Palpus with the 2nd joint not excavated on inner side.
  a^1. Pulvillus present.
    a^2. Fore tibia with spines .... *Thamnoecha.*
    b^2. Fore tibia without spines.
      a^3. Paronychium with two lobes on each side.... *Meganoton.*
      b^3. Paronychium with one lobe on each side...... *Psilogramma.*
  b^1. Pulvillus absent or reduced to a short triangular lobe.
    a^2. Forewing more than 50 mill. long .... *Apocalypsis.*
    b^2. Forewing less than 40 mill. long .... *Pseudodolbina.*
B. Terminal joint of antenna short.
  a. Fore tibia with apical claw ; pulvillus absent........... *Dolbinopsis.*
  b. Fore tibia without claw ; pulvillus present............... *Dolbina.*

Genus Herse.

Type.
Herse, Oken, Lehrb. Naturg., III. p. 762 (1815) .... *convolvuli.*

162. Herse convolvuli.

Sphinx convolvuli, Linn. Syst. Nat., Ed. X. p. 490 (1758).
„ *abadonna,* Fabr. Ent. Syst. Suppl., p. 435 (1798).
„ *patatas,* Mén. Enum. Corp. Anim. Mus. Petr. Lep., p. 90 (1857), non descr.
„ *roseafasciata,* Koch, Indo-Austr. Lep. Fauna, p. 54 (1865).
„ *pseudo-convolvuli,* Schauf. Nunq. Otios., p. 15 (1870).
„ *distans,* Butl. Voy. Erebus & Terror. Zool. Ins., p. 30, pl. 9, f. 11 (1874).
Protoparce orientalis, Butl. Trans. Zool. Soc., Lond., IX. p. 609 (1877).
Sphinx batatæ, Christ. Mitth. Schw. Ent. Ges., VI. p. 346 (1846).
„ *alicea,* Neuburg, Zeitschr. Ent., IV. p. 297 (1899).
„ *nigricans,* Cannaviello, Butl. Soc. Ent. Stal., XXXII. p. 295 (1900).
Habitat.—Eastern Hemisphere, except the higher latitudes.

Genus Megacorma.

Type.
Megacorma, Roths. Nov. Zool., IX, Suppl., p. 15 (1903) .... *obliqua.*

163*a*. Megacorma obliqua.

Macrosila obliqua, Wlk., VIII. 208 (1856).
Sphinx nestor, Boisd. Spec. Gén. Lép. Hét., I., p. 113 (1875).
Habitat.—N. India ; Ceylon ; Burma ; Sumatra ; Java ; New Britain.

Genus Acherontia.

Type.
Acherontia, Lasp. Jenaische Allg. Lit. Zeit., IV. p. 99 (1809).. *atropos.*
Atropos, Oken, Lehrb. Naturg., III. p. 762 (1815) .... *atropos.*
Brachyglossa, Boisd. Ind. Meth., p. 33 (1829)................ .... *atropos.*

Manduca, Hübn. Tent. ined. .... *atropos.*
A. Hindwing above with large black patch on basal half. *lachesis.*
B. Hindwing above with the basal half yellow............ *styx.*

89. ACHERONTIA LACHESIS.

Sphinx lachesis, Fabr. Ent. Syst. Suppl., p. 434 (1798).
Spectrum charon, Billb. Enum. Ins., p 83 (1822) non descr.
Acherontia morta, Hübn. Verz., p. 140 (1827).
„ *satanas*, Boisd. Spec. Gén. Lép. I. pl. 16, f. 1 (1836).
„ *lethe*, Westw. Cat. Or. Ent., p. 87, pl. 42, f. 2 (1848).
„ *circe*, Moore Cat. Lep. E. I. C., p. 267 (1858).
Habitat.—China ; N. & S. India ; Ceylon to Ceram and Amboina.

88. ACHERONTIA STYX.

Sphinx styx, Westw. Cab. Or. Ent., p. 88, pl. 42, f. 3 (1848).
Acherontia medusa, Moore Cat. Lep. E. I. C., p. 266 (1857) non descr.
„ *ariel*, Boisd. Spec. Gén. Lép. Hét., I. p. 6 (1875).
Habitat.—India ; Ceylon ; Burma.
Subsp. *Medusa*, Butl. Tr. Zool. Soc., IX. p. 597, pl. 92, f. 10 (1877) ; *id.* Ill. Hét. B. M., III, p. 3, pl. 41, f. 5.
Acherontia crathis, Roths. Nov. Zool. IX. Suppl., p. 23 (1903).
Habitat.—Japan ; China ; Malay Peninsula to Kissen and Ceram.

Genus MEGANOTON.

Type.
Meganoton, Boisd. Spec. Gén. Lép. Hét., I. p. 58 (1875) .... *nyctiphanes.*
A. Hindwing with pale spots on disk........................... *nyctiphanes.*
B. Hindwing without pale spots on disk—
  a. Abdomen with yellow lateral patches .... *rufescens.*
  b. Abdomen without yellow lateral patches .... *analis.*

167. MEGANOTON NYCTIPHANES.

Macrosila nyctiphanes, Wlk., VIII, p. 209 (1856).
Pseudosphinx cyrtolophia, Butl. P. Z. S., 1875, p. 259.
Habitat.—N. & S. India ; Ceylon ; Burma ; Andamans ; Malacca ; Borneo ; Palawan.

168*a*. MEGANOTON RUFESCENS.

Diludia rufescens, Butl., P. Z. S., 1875, p. 260.
„ *rubescens*, Butl. Trans. Zool. Soc., IX. p. 615 (1877).
Habitat.—Sikhim ; Assam ; Andamans ; Borneo ; Mindanao ; Sula Is.
Subsp. *Severina*, Miskin Proc. Roy. Soc. Queensl., VIII. p. 25 (1891).
Meganoton cocytioides, Roths. Nov. Zool., I. p. 89 (1894).
Habitat.—N. Queensland.

168*b*. MEGANOTON ANALIS.

Sphinx analis, Feld. Reis. Nov., pl. 78, f. 4 (1874).
Diludia grandis, Butl. P. Z. S., 1875, p. 260.
„ *tranquillaris*, Butl. P. Z. S., 1877, p. 641.
Habitat.—China ; Sikhim ; Khasis.

Genus PSILOGRAMMA.

	Type.
Psilogramma, Roths. Nov. Zool., IX. Suppl., p. 42 (1903).......	*menophron.*

169. PSILOGRAMMA MENOPHRON.

Sphinx menophron, Cram. Pap. Exot. III. p. 164 (1780).
Macrosila discistriga, Wlk., VIII. 209 (1856).
,, *casuarinæ*, Wlk., VIII. 210 (1856).
Sphinx emarginata, Moore Cat. Lep. E. I. C., p. 268 (1857).
Macrosila darius, Mén. Enum. Corp. Anim. Mus. Petr. Lép. p. 89 (1857) non descr.
Sphinx abietina, Boisd, Spéc. Gen. Lép. Hét., I. p. 108 (1875).
Diludia vates, Butl. P. Z. S., 1875, p. 13.
,, *nebulosa*, Butl. Trans. Zool. Soc. IX. p. 615 (1877).
,, *melanomera*, Butl. Trans. Zool. Soc., IX. p. 615 (1875).
,, *macromera*, Butl. Trans. Zool. Soc., IX. p. 615 (1875).
Sphinx ahrendti, Pag. Jarb. Nass. Ver. Nat., XLI. p. 104 (1888), non descr.

Habitat.—CHINA; INDIA; CEYLON to NEW GUINEA; AUSTRALIA and the SOLOMON IS.

Subsp. 1, *increta*, Wlk., XXXI. 36 (1864).

Habitat.—JAPAN; COREA; CHINA.

Subsp. 2, *lifuense*, Roths. Nov. Zool., I. p. 90, pl. 7, f. 20 (1894).

Habitat.—LOYALTY IS., LIFU.

Genus APOCALYPSIS.

	Type.
Apocalypsis, Butl. Trans. Zool. Soc., IX. p. 641 (1877)	*velox.*

171. APOCALYPSIS VELOX.

Apocalypsis velox, Butl. Trans. Zool. Soc., IX. p. 641 (1877).

Habitat.—SIKHIM; ASSAM.

Genus PSEUDODOLBINA.

	Type.
Pseudodolbina, Roths. Nov. Zool., I. p. 27 (1894)....................	*fo.*
A. Terminal spurs of hind tibiæ equal in length...........	*æqualis.*
B. Terminal spurs of hind tibiæ unequal	*fo.*

166*a*. PSEUDODOLBINA ÆQUALIS.

Pseudodolbina æqualis, Roths. Nov. Zool., IX. Suppl., p. 101 (1903).

♂. Ground colour of body and forewing of a greenish olive with a distinct yellow tinge. Forewing with the area between the two antemedial lines more or less filled in with black scales, at least in front; the pale parts of cilia greyish white tinged with yellow.

Habitat.—KHASIS.

166. PSEUDODOLBINA FO.

Zonilia fo, Wlk., VIII. 195 (1856).
Pseudodolbina veloxina, Roths. Nov. Zool., I. p. 27, pl. 6, f. 18 (1894).

Habitat.—SIKHIM; KHASIS.

Genus THAMNOECHA.

Type.

Thamnoecha, Roths. Nov. Zool., IX. Suppl., p. 153 (1903)...... *uniformis.*

163. THAMNOECHA UNIFORMIS.

Hyloicus uniformis, Butl. P. Z. S., 1875, p. 261.
Pseudosphinx concolor, Hmpsn. Moths. Ind., I. p. 106 (1892).
Habitat.—N.-W. INDIA.

Genus DOLBINOPSIS.

Type.

Dolbinopsis, Roths. Nov. Zool., IX. Suppl., p. 159 (1903) ...... *grisea.*

165. DOLBINOPSIS GRISEA.

Pseudosphinx grisea, Hmpsn. Moths. Ind., I. p. 104 (1892).
Habitat.—N.-W. INDIA, Kulu.

Genus DOLBINA.

Type.

Dolbina, Staud. Rom. Mém., III. p. 155 (1877)...................... *tancrei.*

164. DOLBINA INEXACTA.

Macrosila inexacta, Wlk., VIII. 208 (1856).
Meganoton khasianum, Roths. Nov. Zool., I. p. 90 (1894).
Habitat.—N.-W. INDIA ; SIKHIM ; ASSAM ; BOMBAY.

Subfamily AMBULICINÆ.

A. Mid tibia with spines.
  a. Hind tibia with one pair of spurs.
    a^1. Hindwing with veins 6·7 on a long stalk............... *Daphnusa.*
    b^1. Hindwing with veins 6·7 shortly stalked or from cell. *Marumba.*
  b. Hind tibia with two pairs of spurs.
    a^1. Frenulum absent.. *Phyllosphingia.*
    b^1. Frenulum present.
      a^2. Forewing with broad pale yellow streak from base to apex.. *Leucophlebia.*
      b^2. Forewing without such streak.
        a^3. Palpus with the joint open........................... *Polyptychus.*
        b^3. Palpus with the joint not open.................... *Clanis.*
B. Mid tibia without spines.
  a. Hind tibia with one pair of spurs.
    a^1. Frenulum absent.. *Anambulyx.*
    b^1. Frenulum present.
      a^2. Fore tibia ending in a thorn........................... *Agnosia.*
      b^2. Fore tibia without thorn .... *Parum.*
  b. Hind tibia with two pairs of spurs.
    a^1. Frenulum absent.. *Sphinx.*
    b^1. Frenulum present.
      a^2. Pulvillus absent.. *Clanidopsis.*
      b^2. Pulvillus present.

a^3. Antenna with the terminal joint long.

a^4. Spurs very short.................................... *Cypa.*

b^4. Inner spurs long.

a^5. Forewing with the apex acute.............. *Oxyambulyx.*

b^5. Forewing with the apex truncate.......... *Compsogene.*

b^3. Terminal joint of antenna short.

a^4. Spurs short.

a^5. Hindwing with the costa dilated into a lobe... *Degmaptera.*

b^5. Hindwing with the costa normal.

a^6. Forewing with the apex acute, the termen even .... *Callambulyx.*

b^6. Forewing with the apex sinuate, the termen uneven .... *Smerinthulus.*

b^4. Spurs long.

a^5. Forewing with termen uneven............... *Langia.*

b^5. Forewing with the termen even .... *Rhadinopasa.*

Genus Compsogene.

Type.

Calymnia, Wlk., VIII. 123 (1856) nec. Hübn., 1827 .... *panopus.*

Compsogene, Roths. Nov. Zool., IX. Suppl., p. 188 (1902)......... *panopus.*

102. Compsogene panopus.

Sphinx panopus, Cram. Pap. Exot., III. p. 50, pl. 224, f. A. B. (1779).

Calymnia pavonica, Moore P. Z. S., 1877, p. 596.

Habitat.—China; India; Ceylon; Andamans; Java; Borneo; Philippines; Celebes.

Genus Oxyambulyx.

Type.

Oxyambulyx, Roths. Nov. Zool., IX. Suppl., p. 192 (1903) ...... *substrigilis.*

A. Forewing with the subbasal spots mixed with white.. *subocellata.*

B. Forewing with the subbasal spots not mixed with white.

a. Forewing with three subbasal spots below the cell.. *canescens.*

b. Forewing with one subbasal spot below the cell.

a^1. Forewing with round subbasal spot on costa beyond the subbasal bar.

a^2. Abdomen without dorsal line .... *ochracea.*

b^2. Abdomen with dorsal line.

a^3. Forewing with the apical line of cell oblique; subterminal line reaching inner margin... *placida.*

b^3. Forewing with the apical line of cell erect; subterminal line ending at or before angle of wing.

*a*⁴. Forewing with the subterminal line on underside absent .... *lahora.*
*b*⁴. Forewing with the subterminal line on underside present.
  *a*⁵. Forewing with the terminal grey area ending at a point at vein 3.............. *maculifera.*
  *b*⁵. Forewing with the terminal grey area continued beyond vein 3.................. *sericcipennis.*
*b*¹. Forewing without subbasal spot on costa beyond the subbasal bar.
  *a*². Hindwing without dark basal patch .... *liturata.*
  *b*². Hindwing with dark basal patch.................. *substrigilis.*

103*a*. Oxyambulyx sericeipennis.

Ambulyx sericeipennis, Butl. P. Z. S., 1875, p. 252.

Habitat.—Punjab ; Sikhim ; Assam ; Burma ; Tenasserim.

103*b*. Oxyambulyx placida.

Ambulyx placida, Moore P. Z. S., 1888, p. 390.

Habitat.—Punjab ; Sikhim.

103*c*. Oxyambulyx maculifera.

Ambulyx maculifera, Wlk., XXXV. 185 (1866).
„ *consanguis*, Butl. Ill. Hét. B. M. V., p. 11, pl. 80, f. 2 (1881).

Habitat.—Sikhim.

103*d*. Oxyambulyx lahora.

Ambulyx lahora, Butl. P. Z. S., 1875, p. 251.

Habitat.—Punjab ; Lahore.

103*e*. Oxyambulyx ochracea.

Ambulyx ochracea, Butl. Cist. Ent., III. p. 113 (1885).

Habitat.—Japan ; Sikhim.

103*f*. Oxyambulyx liturata.

Ambulyx liturata, Butl. P. Z. S., 1875, p. 250.
„ *rhodoptera*, Butl. P. Z. S., 1875, p. 251.

Habitat.—Sikhim.

103. Oxyambulyx substrigilis.

Ambulyx substrigilis, Westw. Cab. Or. Ent., p. 61, pl. 30, f. 2 (1848).
„ *philemon*, Boisd. Consid. Lep. Guatemala, p. 68 (1870).

Habitat.—Sikhim ; Assam ; Andamans.

Subsp. 1, *auripennis*, Moore P. Z. S., 1879, p. 388.

Habitat.—Ceylon.

Subsp. 2, *pryeri*, Dist. A. M. N. H. (5), XX. p. 271 (1887).

Habitat.—Malacca ; Sumatra ; Borneo.

Subsp. 3, *eteocles*, Huwe. Bul. Ent. Zeitrchr., XL. p. 367 (1895)

Habitat.—Java.

Subsp. 4, *standingeri*, Roths. Iris., VII. p. 390, pl. 7, f. 1.

Habitat.—Philippines.

104*a*. Oxyambulyx canescens.
Ambulyx canescens, Wlk., XXXI. 38 (1864).
„ *argentata*, Druce. Ent. Mo. Mag., XIX. p. 17 (1882).
Habitat.—Andamans ; Penang ; Cochin China ; Cambodia ; Borneo.

104. Oxyambulyx subocellata.
Ambulyx subocellata, Feld. Reis. Nov., pl. 76, f. 3 (1874).
„ *turbata*, Moore P. Z. S., 1875, p. 252.
„ *thwaitesi*, Moore Lep. Ceyl., II. p. 11, pl. 80, f. 2 (1882).
Habitat.—Sikhim ; Assam ; Ceylon ; Andamans ; Penang ; Sumatra.

Genus Clanis.

Type.
Clanis, Hübn. Verz., p. 138 (1827) .... *phalaris.*
Basiana, Wlk., VIII. 236 (1856) .... *deucalion.*
Metagastes, Boisd. Spec. Gén. Lép. Hét. I. p. 11 (1875)......... *phalaris.*

A. Forewing on underside with a black streak below the cell—
  a. Mid tibia white above .... *bilineata.*
  b. Mid tibia not white above.
    a^1. Forewing with the costal area pale .... *undulosa.*
    b^1. Forewing with the costal area not pale ...... *deucalion.*
B. Forewing on underside without black streak below the cell—
  a. Mid tibia with white streak on upperside ...... *titan.*
  b. Mid tibia without white streak on upperside ... *phalaris.*

110. Clanis bilineata.
Basiana bilineata, Wlk., XXXV. 1857 (1866).
Habitat.—Japan ; Corea ; Sikhim ; Assam ; Calcutta.

110*a*. Clanis undulosa.
Clanis undulosa, Moore P. Z. S., 1879, p. 387.
„ *gigantea*, Roths. Nov. Zool., I. p. 96 (1894).
Habitat.—China ; Sikhim ; Assam.

111. Clanis deucalion.
Basiana deucalion, Wlk., VIII. 237 (1856).
Habitat.—Punjab, Kulu.

109. Clanis phalaris.
Sphinx phalaris, Cram. Pap. Exot., II. p. 83, pl. 149, f. A (1777).
„ *pagana*, Fabr. Spec. Ins. II. p. 146 (1781).
„ *nicobarensis*, Schwarz, Nomencl., Ross. & Kleem, II. p. 1, pl. 1, ff. 1-2 (1840).
Basiana cervina, Wlk., VIII. 237 (1856).
Habitat.—Sikhim ; Ceylon ; Nicobars.

109*a*. Clanis titan.
Clanis titan, Roths. Nov. Zool., IX. Suppl., p. 218 (1903).
Habitat.—Sikhim ; Khasis.

Genus Leucophlebia.

	Type.
Leucophlebia, Westw. Cab. Or. Ent., p. 46 (1848)...............	*lineata.*
Rasphale, Boisd. Spec. Gén. Lép. Hét., I. p. 55 (1875).........	*lineata.*
A. Abdomen dorsally black except the spines............	*lineata.*
B. Abdomen not dorsally black..............................	*emittens.*

100. Leucophlebia lineata.

Leucophlebia lineata, Westw. Cab. Or. Ent., p. 46, pl. 22, f. 2 (1848).
,, *luxeri*, Boisd. Spec. Gén. Lép. Hét., I. p. 55 (1875).
,, *rosacea*, Butl. P. Z. S., 1875, p. 15, pl. 2, f. 4.

Habitat.—China ; Formosa ; Punjab ; Nepal ; Assam ; Nilgiris ; Travancore ; Ceylon ; Java ; Philippines ; Celebes ; Flores.

101. Leucophlebia emittens.

Leucophlebia emittens, Wlk., XXXV. 1858 (1866).
,, *bicolor*, Butl. P. Z. S., 1875, p. 16, pl. 2, f. 5.
,, *damascena*, Butl. P. Z. S., 1875, p. 392.

Habitat.—Punjab ; Sikhim ; Bombay ; Central India ; Burma.

Genus Polyptychus.

	Type.
Polyptychus, Hübn. Verz., p. 141 (1827)...........................	*dentatus.*
Andriasa, Wlk., VII, 1735 (1856)..................................	*contraria.*
Pseudosmerinthus, Butl. Trans. Zool. Soc., IX. p. 593 (1877).	*contraria.*
Devitzia, Holl. Trans. Am. Ent. Soc., XVI. p. 65 (1889)	*contraria.*
A. Forewing with the subterminal line straight.........	*dentatus.*
B. Forewing with the subterminal line excurved at middle..	*trilineatus.*

90*a*. Polyptychus trilineatus.

Polyptychus trilineatus, Moore P. Z. S., 1888, p. 390.

Habitat.—Punjab.

Subsp. 1, *luteatus*, Roths. Nov. Zool., IX. Suppl., p. 237 (1903).

Habitat.—Ceylon.

Subsp. 2, *undatus*, Roths. Nov. Zool., IX. Suppl., p. 238 (1903).

Habitat.—Sikhim ; Assam.

Subsp. 3, *chinensis*, Roths. Nov. Zool., IX. Suppl., p. 239 (1903).

Habitat.—China.

Subsp. 4, *philippinensis*, Roths. Nov. Zool., IX. Suppl., p. 239 (1903).

Habitat.—Philippines.

90. Polyptychus dentatus.

Sphinx dentatus, Cram. Pap. Exot., II. p. 42, pl. 125, f. G (1777).
,, *timesius*, Stoll. Cram. Pap. Exot., Suppl., p. 172, pl. 40, f. 1 (1790).
,, *modesta*, Fabr. Ent. Syst., III. p. 356 (1793).

Habitat.—Sind ; Bombay ; Calcutta ; S. India ; Ceylon.

Genus Marumba.

Type.

Marumba, Moore, Lep. Ceyl., II, p. 8 (1882)..................... *dyras.*

A. Fore tibia with claw at extremity .... *indicus.*

B. Fore tibia without claw at extremity.

  a. Forewing on underside with large well-defined fulvous patch near tornus .... *spectabilis.*

  b. Forewing with the patch absent, or small clay-coloured and ill-defined.

    a^1. Abdomen with prominent dorsal line; wings without pale shades................................. *cristata.*

    b^1. Abdomen without prominent dorsal line, or wings with pale shades.

      a^2. Forewing with the subterminal line double, the outer line stronger .... *dyras.*

      b^2. Forewing with the subterminal line single, or the outer line obsolescent................. *sperchius.*

        a^3. Forewing with the basal, medial and subterminal areas pale; hind wing red-brown.

        b^3. Forewing with the basal, medial and subterminal areas purplish pink; hind wing dark-brown .... *nympha.*

92*a*. Marumba cristata.

Triptogon cristata, Butl. P. Z. S., 1875, p. 253.

Habitat.—W. China; Sikhim.

92. Marumba spectabilis.

Triptogon spectabilis, Butl. P. Z. S., 1875, p. 256.

Habitat.—Sikhim.

Subsp. *malayana*, Roths. Nov. Zool., IX., Suppl., p. 274 (1903).

Habitat.—W. Sumatra.

91. Marumba dyras.

Smerinthus dyras, Wlk., VIII, 250 (1856).

Triptogon sinensis, Butl. P. Z. S., 1875, p. 254.

„ *ceylanica*, Butl. P. Z. S., 1875, p. 255.

„ *silhetensis*, Butl. P. Z. S., 1875, p. 255.

„ *oriens*, Butl. P. Z. S., 1875, p. 255.

„ *massurensis*, Butl. P. Z. S., 1875, p. 256.

„ *fuscescens*, Butl. P. Z. S., 1875, p. 256.

„ *andamana*, Moore P. Z. S., 1877, p. 595.

Habitat.—China; N.-W. India; Sikhim; Bhutan; Assam; S. India; Ceylon; Burma; Tenasserim; Tonkin; Andamans.

Subsp. *javanica*, Butl. P. Z. S., 1875, p. 254.

Smerinthus parallelis, Moore Cat. Lep. E. I. C., p. 264 (1857) non descr.

Smerinthus horsfieldii, Moore Cat. Lep. E. I. C., p. 264 (1857) non descr.

Habitat.—PHILIPPINES ; JAVA.

91*a*. MARUMBA SPERCHIUS.

Smerinthus sperchius, Mén. Enum. Corp. Anim. Mus. Petr. Lep., II. p. 137, pl. 13, f. 5 (1857).

Triptogon piceipennis, Butl. A. M. N. H. (4), XX. p. 393 (1877).

Smerinthus michaelis, Oberth. Bull. Soc. Ent. Fr., 1886, p. 56.

Habitat.—AMURLAND ; MANCHURIA ; JAPAN ; CHINA ; LOO CHOO IS.

Subsp. 1, *gigas,* Butl. P. Z. S., 1875, p. 253.

Habitat.—ASSAM.

Subsp. 2, *albicans,* Butl. P. Z. S., 1875, p. 254.

Habitat.—PUNJAB.

91*b*. MARUMBA INDICUS.

Smerinthus indicus, Wlk., VIII. 254 (1856).

Triptogon rectilinea, Moore P. Z. S., 1879, p. 388.

Habitat.—N. INDIA.

91*c*. MARUMBA NYMPHA (pl. D f. 17).

Marumba nympha, Roths. Nov. Zool., IX., Suppl., p. 806 (1903).

♂. Head and thorax red-brown tinged with pink except on dorsum of thorax and abdomen and on ventral surface ; palpi at sides, tibiæ and tarsi fuscous. Forewing red-brown ; the basal area suffused with pink and whitish, except on costal area crossed by the indistinct rufous subbasal and antemedial slightly incurved lines ; a medial oblique rufous band edged by rather darker lines and with a wedge-shaped pinkish band beyond it from below costa to inner margin with a slight whitish discoidal spot on it ; a postmedial pinkish band not extending to costa, edged by darker lines which extend to costa, towards which they are incurved, also incurved slightly at middle and strongly below vein 3, and with a dark-brown ocellate spot with grey annulus above vein 1 ; the inner margin grey towards tornus with a black-brown semicircular mark on it ; the costal area tinged with pink before apex. Hindwing dark red-brown tinged with grey towards inner margin ; traces of a curved subterminal line and of a dark spot in submedian fold ; a more distinct black lunule at tornus ; the underside pale red-brown suffused with pink on basal area and grey on inner area ; two nearly straight oblique medial rufous lines.

Habitat.—N. KANARA ; KARWAR (T. R. Bell). *Exp.* 80 mill. Type in B. M.

Larva like that of *P. dyras,* but stouter. Food-plant *Alseodaphne semicarpifolia* (Laurineæ).

Genus DAPHNUSA.

	Type.
Daphnusa, Wlk., VIII, 237 (1856)	*ocellaris.*
Allodaphnusa, Huwe Berl. Ent. Zeitschr., XL. p. 368 (1895).	*ocellaris.*

97. DAPHNUSA OCELLARIS.

Daphnusa ocellaris, Wlk., VIII. 237 (1856).

„ *orbifera,* Wlk., Journ. Linn. Soc. Zool., VI., p. 85 (1862).

Smerinthus oculata, Boisd. Spec. Gén. Lép. Hét., I, p. 29 (1875).

Allodaphnusa fruhstorferi, Huwe Berl. Ent. Zeitschr., XL. p. 368 (1895).

Habitat.—ASSAM ; BURMA ; BASSEIN ; PENANG ; SELANGOR ; PAHANG ; SINGAPORE ; SUMATRA ; BORNEO ; PHILIPPINES ; CELEBES.

Subsp. *ailanti*, Boisd. Spec. Gén. Lép. Hét., I. p. 28, pl. 3, f. 2 (1875).

Habitat —HONGKONG.

Genus LANGIA.

Type.

Langia, Moore P. Z. S., 1872, p. 567 (1872) .... *zenzeroides.*

99. LANGIA ZENZEROIDES.

Langia zenzeroides, Moore P. Z. S., 1872, p. 567.

„ *khasiana*, Moore P. Z. S., 1872, p. 568.

Habitat —CHINA (Yunnan) ; PUNJAB ; SIKHIM ; ASSAM.

Subsp. *nawai*, Roths. Nov. Zool., IX. Suppl., p. 292 (1903).

Habitat.—JAPAN.

Genus RHODOPRASINA.

Type.

Rhodoprasina, Roths. Nov. Zool., IX., Suppl., p. 292 (1903) ... *floralis.*

96. RHODOPRASINA FLORALIS.

Ambulyx floralis, Butl. Trans. Zool. Soc., IX. p. 639 (1877).

Habitat.—SIKHIM.

Genus CLANIDOPSIS.

Type.

Clanidopsis, Roths. Nov. Zool., IX., Suppl. p. 294 (1903) ...... *exusta.*

113. CLANIDOPSIS EXUSTA.

Basiana exusta, Butl. P. Z. S., 1875, p. 252.

Habitat.—PUNJAB.

Genus AGNOSIA.

Type.

Agnosia, Roths. Nov. Zool., IX., Suppl., p. 294 (1903)......... *orneus.*

114. AGNOSIA ORNEUS.

Sphinx orneus, Westw. Cab. Or. Ent., p. 13, pl. 16, f. 3 (1848).

Basiana pudorina, Butl. Trans. Zool. Soc., IX. p. 596 (1877).

Habitat.—PUNJAB ; CENTRAL INDIA ; CEYLON.

Genus PARUM.

Type.

Parum, Roths. Nov. Zool., IX., Suppl., p. 295 (1903)......... *colligata.*

98. PARUM PORPHYRIA.

Daphnusa porphyria, Butl. Trans. Zool. Soc., IX. p. 640 (1877).

Habitat.—SIKHIM.

Genus CYPA.

Type.

Cypa, Wlk., XXXI. 41 (1864) .... *decolor.*

94. CYPA DECOLOR.

Smerinthus decolor, Wlk., III. 255 (1856).

Cypa incongruens, Butl Ill. Het. B. M., V. p. 12, pl. 80, ff. 8-9 (1881).

Habitat.—SIKHIM ; BURMA, Shán States.

Subsp. 1, *ferruginea*, Wlk., XXXI. 42 (1864).

Habitat.—CEYLON.

Subsp. 2, *euroa*, Roths. Nov. Zool., IX., Suppl., p. 299 (1903).

Habitat.—NEW GUINEA, Milne Bay.

Genus SMERINTHULUS.

Type.

Smerinthulus, Huwe, Berl. Ent. Zeitschr., XL., p. 370 (1895). *quadripunctatus.*

A. Hindwing with diffused blackish postmedial band.. *perversa.*

B. Hindwing without diffused blackish postmedial band .... *decoratus.*

93*a*. SMERINTHULUS PERVERSA.

Cypa perversa, Roths. Nov. Zool. II. p. 28 (1895).

Habitat.—SIKHIM ; KHASIS.

93. SMERINTHULUS DECORATUS.

Smerinthus decoratus, Moore P. Z. S., 1872, p. 568.

Habitat.—SIKHIM.

Genus DEGMAPTERA.

Type.

Degmaptera, Hmpsn. Moths. Ind., IV. p. 452 (1896) .... *mirabilis.*

92*a*. DEGMAPTERA MIRABILIS.

Cypa mirabilis, Roths. Nov. Zool., I. p. 542 (1894).

Habitat.—SIKHIM ; KHASIS.

Genus CALLAMBULYX.

Callambulyx, Roths. Nov. Zool., IX, Suppl., p. 307 (1903) ... *rubricosa.*

A. Hindwing with large white-centred black postmedial patch.. *junonia.*

B. Hindwing with the black patch subterminal, when present, and with a white dot below it.

  a. Forewing with the basal area suffused with red on underside .... *pœcilus.*

  b. Forewing with the basal area not suffused with red on underside .... *rubricosa.*

106. CALLAMBULYX RUBRICOSA.

Ambulyx rubricosa, Wlk., VIII., 122 (1856).

Basiana superba, Moore P. Z. S., 1865, p. 793.

Habitat.—SIKHIM ; KHASIS.

Subsp. 1, *pieporsi*, Snell. Tijd., v. Ent. XXIII., Versl., p. 22 (1880).

Habitat.—JAVA.

Subsp. 2, *amanda*, Roths. Nov. Zool., IX., Suppl., p. 309 (1903).

Habitat.—MALACCA, M. Takau ; BORNEO, Kina Balu.

107. Callambulyx junonia.

Ambylyx junonia, Butl. Ill. Het. B. M. V., p. 9, pl. 80, f. 2 (1881).

Habitat.—Bhutan; Naga Hills.

106*a*. Callambulyx pœcilus.

Ambulyx pœcilus, Roths. Nov. Zool., V. p. 604, f. 2 (1898).

Habitat.—Punjab, Murree.

Genus Anambulyx.

	Type.
Anambulyx, Roths. Nov. Zool. IX., Suppl., p. 319 (1903)	*elwesi.*

108. Anambulyx elwesi.

Ambulyx elwesi, Druce, Ent. Mo. Mag., XIX. p. 17 (1882).

Habitat.—Sikhim; Assam.

Genus Sphinx.

Sphinx, Linn. Syst. Nat., X. p. 489 (1758)	*ocellata.*
Laothöe, Fabr. Illig. Mag. Ent., VI. p. 287 (1807)...............	*ocellata.*
Pilina, Dalm. Kongl. Vet. Ak. Handl., XXXVII. p. 212 (1816).	*ocellata.*
Paonias, Hübn. Verz., p. 142 (1827)................................	*ocellata.*
Eusmerinthus, Grote, Can. Ent., IX p. 132 (1877)	*jamaicensis.*
Copismerinthus, Grote, Hawk Moths, N. Am., p. 35 (1886) ...	*cerisyi.*

96*a*. Sphynx kindermanni.

Smerinthus kindermanni, Led. Verh. Zool. Bot. Ges. Win., II., p. 22 (1852).

Habitat.—Asia Minor; Caucasus.

Subsp. 1, *orbata*, Grum. Grishm Rom. Mem., IV. p. 512 (1890).

Habitat.—Transcaspia; Turkistan; N. Afghanistan.

Subsp. 2, *obsoleta*, Staud. Cat. Lep. pal., p. 100 (1901).

Head tegulæ and patagia grey, head tinged with brown; thorax olive-brown above; abdomen grey dorsally tinged with brown. Forewing olive-grey; a little pink at base of inner margin; a curved whitish subbasal line; an antemedial red-brown line strongly angled outwards below vein 2 and meeting the medial line which is angled inwards, the area between the two lines being filled in with red-brown suffusion from cell to inner margin; a sinuous grey postmedial line angled inwards on vein 5 and defined on inner side by darker olive; a red-brown patch on termen extending down to vein 3 and bounded above by a white line from apex dentate on vein 7; a rufous patch at tornus. Hindwing pale red-brown largely suffused with pink, the inner area pale or tinged with pink; a diffused rufous antemedial line and slightly sinuous grey medial and postmedial lines, with a more or less prominent dark patch with olive-grey mark on it towards tornus; the cilia white. Underside of forewing with the basal half crimson except costa; hindwing crimson with blackish patch near tornus with two blue-grey lines on it.

Habitat.—E. Turkistan; Chitral; Afghanistan, Kandahar.

Genus Phyllosphingia.

	Type.
Phyllosphingia, Swinh. A. M. N. H. (6) XIX. p. 164 (1897)...	*dissimilis.*
Clarkia, Tutt. Brit. Lep. III. p. 386 (1902)	*dissimilis.*

92*b*. PHYLLOSPHINGIA DISSIMILIS.

Triptogon dissimilis, Brem. Bull. Ac. St. Petersb., III. p. 475 (1861).

Habitat.—Amurland; Japan; China, Kiukiang.

Subsp. *perundulans*, Swinh. A. M. N. H. (6), XIX., p. 164 (1897).

Habitat.—Assam, Jaintia Hills.

Sub-family SESIANÆ.

A. Abdomen with the spines of distal tergites uniseriate... *Sataspes.*

B. Abdomen with the spines of distal tergites not uniseriate.

  a. Hindwing with the cell very short; veins 3·4 stalked .... *Cephonodes.*

  b. Hindwing with the cell two or three times as long as broad.. *Hæmorrhagia.*

Genus HÆMORRHAGIA.

Type.

Hæmorrhagia, Grote and Rob. Proc. Ent. Soc. Philad., V. p. 173 (1865) .... *thisbe.*

Chamæsesia, Grote, Bull. Buff. Soc. Nat. Sci., III, p. 220 (1877). *gracilis.*

A. Hindwing ferruginous without hyaline interspaces ... *rubra.*

B. Hindwing hyaline with reddish or black terminal band.

  a. Forewing with scaled fold in cell .... *fuciformis.*

  b. Forewing without scaled fold in cell .... *saundersi.*

202. HÆMORRHAGIA FUCIFORMIS.

Sphinx fuciformis, Linn. Syst. Nat., ed. X., p. 493 (1758).

„ *variegata*, Allioni. Mèl. Soc. Turin, p. 193 (1766).

„ *bombyliformis*, Illiger. Den. and Schiff. Wien. Verz., ed. II., p. 22 (1800).

Macroglossa milesiformis, Treitshke,; Ochs. Schmett. Eur., X., I., p. 125 (1834).

„ *loniceræ*, Zell. Stett. Ent. Zeit., XXX., p. 387 (1869).

„ *caprifolia*, Zell. Stett. Ent. Zeit., XXX., p. 387 (1869).

„ *robusta*, Alph. Hor. Soc. Ent. Ross., XVII., p. 17 (1882).

Hemaris simillima, Moore P. Z. S., 1888, p. 391.

Macroglossa heynei, Bartel Ent. Nachr., XXIV. p. 337 (1898).

Habitat.—Europe; N. Africa; W. Asia; W. Siberia; Turkestan; Punjab. Kangra.

Subsp. 1, *ganssuensis*, Grum. Grschm. Hor. Soc. Eur. Ross, XXV., 461 (1891).

Habitat.—Tibet.

Subsp. 2, *affinis*, Brem. Bull. Ac. St. Petersb., III., p. 475 (1861).

Macroglossa sieboldi, Orza. Lép. Japon, p. 35 (1868).

Sesia whitelyi, Butl. A. M. N. H. (4), XIV., p. 367 (1874).

Habitat.—Amurland; Japan; Corea; China.

203. HÆMORRHAGIA SAUNDERSI.

Sesia saundersi, Wlk., VIII., 83 (1856).

Macroglossa curtisi, Boisd. Spec. Gén. Lép. Hét., I., p. 374 (1875).

Habitat.—Punjab; Kashmir; Cochin China.

204. HÆMORRHAGIA RUBRA.

Hemaris rubra, Hmpsn. Moths. Ind., I. p. 120 (1892).

Habitat.—KASHMIR.

Genus CEPHONODES.

	Type.
Cephonodes, Hübn. Verz., p. 131 (1827)	*hylas.*
Potidœa, Wllgrn. Kongl. Sv. Vet. Ak. Handl. (2) V. 4, p. 17 (1865)	*hylas.*
A. Fore tibia without apical claw	*hylas.*
B. Fore tibia with apical claw	*picus.*

205. CEPHONODES HYLAS.

Sphinx hylas, Linn. Mant. Plant., p. 539 (1771).

Habitat.—JAPAN; LOO CHOO IS, CHINA; FORMOSA; TONKIN; PUNJAB; SIKHIM; ASSAM; BENGAL; BOMBAY; MADRAS; CEYLON.

Subsp. 1, *virescens*, Wllgrn. Kongl. Sv. Vet. Akad. Handl. (2) V. 4, p. 17 (1865).

Macroglossa confinis, Boisd. Spec. Gén. Lép. Hét., I., p. 376 (1875).

Habitat.—W., E. & S. AFRICA; MADAGASCAR.

Subsp. 2, *cunninghami*, Wlk., VIII., 85 (1856).

Habitat.—FLORES; DILI; TIMOR; QUEENSLAND.

205*a*. CEPHONODES PICUS.

Sphinx picus, Cram. Pap. Exot., II., p. 38. pl 148, f. B. (1777).

Macroglossa yunx, Boisd. Spec. Gén. Lép. Hét., I., p. 376 (1875).

Habitat—NILGIRIS; CEYLON; PENANG; JAVA; CHRISTMAS I.; SUMBA; KISSEN; TIANDÆ IS; NEW GUINEA; QUEENSLAND.

Genus SATASPES.

	Type.
Sataspes, Moore. Cat. Lép. E. I. E., p. 261 (1857).	*infernalis.*
Myodezia, Boisd. Spec. Gén. Lép. Hét., I., p. 377 (1875)	*infernalis.*
A. Abdomen with the posterior sternites yellow at sides only	*infernalis.*
B. Abdomen with the posterior sternites yellow	*tagalica.*

206. SATASPES INFERNALIS.

Sesia infernalis, Westw. Cab. Or. Ent., p. 61, pl. 30, f. 3 (1848).

Sataspes uniformis, Butl. P. Z. S., 1875, p. 3.

" *xylocoparis*, Butl. P. Z. S., 1875, p. 239.

Habitat.—CHINA; NEPAL; SIKHIM; BHUTAN; ASSAM; COIMBATORE; BURMA.

Subsp. *glossatrix*, Roths. Nov. Zool., IX., Suppl., p. 473 (1903).

Habitat.—BORNEO; JAVA.

207. SATASPES TAGALICA.

Sataspes tagalica, Boisd. Spec. Gén Lép. Hét., I. p. 372, pl. 20, ff. 3 4 (1875).

" *ventralis*, Butl. P. Z. S., 1875, p. 3.

" *cerberus*, Semp. Schmett. Phil., II., p. 408 (1896).

" *hauxwelli*, De Nice. J. Bomb. N. H. Soc., XIII., p. 173, pl. E. E., f. 22 (1900).

Sataspes thoracica, Roths. Nov. Zool., IX., Suppl., p. 474 (1903).
„ *collaris*, Roths. Nov. Zool., IX., Suppl., p 474 (1903).
Habitat.—HONGKONG ; SIKHIM ; ASSAM ; BURMA ; PHILIPPINES.

Sub-family MACROGLOSSINÆ.

Key to the genera.

- A. Abdominal tergites with the spines of the 1st row not longer than broad.
  - *a*. Antennæ of male with fasciculate cilia .... *Macroglossum.*
  - *b*. Antennæ of male without fasciculate cilia .... *Rhopalopsyche.*
- B. Abdominal tergites with the spines of the 1st row longer than broad.
  - *a*. Fore tibia spinose.
    - a^1. Hindwing with the costa deeply sinuate .... *Gurelca.*
    - b^1. Hindwing with the costa not sinuate............... *Sphingonæpiopsis.*
  - *b*. Fore tibia not spinose.
    - a^1. Pulvillus and paronychium absent .... *Rethera.*
    - b^1. Pulvillus and paronychium present.
      - a^2. Antenna with the terminal joint long, filiform.
        - a^3. Mid and hind tibia with the shorter spurs with comb of bristles ... . *Nephele.*
        - b^3. Mid and hind tibia with the shorter spurs without comb of bristles.
          - a^4. Forewing with the termen scolloped, angulate or dentate.
            - a^5. Antenna with the terminal joint not scaled, with a number of very long bristles .... *Panacra.*
            - b^5. Antennæ with the terminal joint scaled. *Acosmeryx.*
          - b^4. Forewing with the termen evenly curved.
            - a^5. Antenna with the terminal joint not scaled, with very long bristles .... *Chromis.*
            - b^5. Antenna with the terminal joint scaled. *Deilephila.*
      - b^2. Antenna with the terminal joint short.
        - a^3. Eyes strongly lashed ; abdomen with the spines of stemites strong .... *Rhodosoma.*
        - b^3. Eyes not lashed ; abdomen with the spines of sternites slender.
          - a^4. Mid tibia with the spurs equal or nearly equal and very short.
            - a^5. Forewing strongly falcate .... *Dahira.*
            - b^5. Forewing not falcate.
              - a^6. Eye not lashed .... *Enpinanga.*
              - b^6 Eye lashed .... *Cizara.*

b^4. Mid tibiæ with the spurs unequal.
  a^5. Hind tibia with the long terminal spur at least half the length of 1st tarsal joint, which is shorter than 1st mid tarsal joint .... *Angonyx.*
  b^5. Hind tibiæ with the long terminal spur shorter, or 1st hind tarsal joint longer than the 1st mid tarsal joint.
    a^6. Abdomen with sharply marked pale mesial line.
      a^7. Palpi and eyes large; hind tarsus with the 1st joint longer than tibia .... *Elibia.*
      b^7. Palpi and eyes smaller; hind tarsus with the 1st joint not longer than tibia................................ *Ampelophaga.*
    b^6. Abdomen without sharply marked pale medial line .... *Eurypteryx.*

Genus Chromis.

	Type.
Chromis, Hubn. Verz., p. 138 (1827)	*erotus.*
Gnathothlibus, Wllgrn. Wien. Ent. Mon., IV., p. 43 (1860) ...	*erotus.*

145. Chromis erotus.

Sphinx erotus, Cram. Pap. Eot., II., p. 12, pl. 104, f. B. (1777).

Chærocampa andamanensis, Kirby. Trans. Ent. Soc., 1877, p. 242.

Habitat.—Ceylon; Andamans; Nicobars; Borneo; Java; Celebes; Sambawa; Sumba.

Subsp. *eras.*, Boisd. Voy. Astroiabe Lép, p. 185 (1832).

Gnathothlibus crotoides, Wllgrn. Wien. Ent. Mon., IV., p. 43 (1860).

Chærocampa sapor, Koch. Stett. Ent. Zeit., XXXII., p. 293 (1871).

Habitat.—Moluccas; Tenimber Is.; Guam; New Guinea; Lovisiades; Solomons; New Hanover; Lifu; Tahiti.

Genus Deilephila.

	Type.
Deilephila, Lasp. Jen. Allg. Liter-Zeit., IV., p. 99 (1809) ...	*nerii.*
Elpenor, Oken., Lehrb. Nat., III., I., p. 760 (1815)	*nerii.*
Chærocampa, Dup. Lep. Fr. Suppl., II., p. 159 (1835).........	*nerii.*
Metopsilus, Duncan, Jardine's Nat. Libr., XL., p. 154 (1836).	*nerii.*

A. Forewing with the pale apical line widening to a spot near apex.
  a. Forewing with the green subbasal area recurved below costa .... *layardi.*
  b. Forewing with the green subbasal area not recurved below costa .... *hypothous.*

B. Forewing with the pale apical line simple.
  a. Abdomen without pale subbasal band.................. *minima.*
  b. Abdomen with pale subbasal band.
    *a*¹. Tegulæ and subbasal band of forewing bright olive-green .... *nerii.*
    *b*¹. Tegulæ and subbasal band of forewing blackish or brownish olive-green .... *placida.*

46. DEILEPHILA NERII.

Sphinx nerii, Linn. Syst. Nat., X., p. 490 (1758).

Daphnis infernelutea, Saalm. Lep. Mad., p. 123 (1884).

Habitat.—Europe; Æthiopian Region; W. Asia; Punjab; Sikhim; S. India; Ceylon.

147. DEILEPHILA HIPOTHOUS.

Sphinx hypothous, Cram. Pap. Exot., II ., p. 165, pl. 285, f. D. (1780).

Habitat.—Sikhim; S. India; Ceylon; Burma; Malacca; Sumatra; Borneo; Java; Sumba; Celebes; Amboina; Tenimber Is; Key Is.

Subsp. *pallescens*, Butl. P. Z. S., 1875, p. 6.

Daphnis magnifica, Butl. A. M. N. H. (4) XIX., p. 461 (1877).

,, *gloriosa*, Roths. Nov. Zool., I., p. 85 (1894).

Habitat.—New Guinea; Fergusson I.; New Meklenberg; Solomon Is.; Queensland.

149. DEILEPHILA LAYARDI.

Daphnis layardi, Moore Lep. Ceyl. II., p. 16, pl. 84, f. 1 (1882).

Habitat.—Ceylon.

148. DEILEPHILA PLACIDA.

Darapsa placida, Wlk., VIII, 186 (1856).

Daphnis angustans, Feld. Reis. Nov., pl. 76, f. 6 (1874).

Chærocampa hesperus, Boisd. Spec. Gén. Lép. Hét., I. p. 228 (1875).

Daphnis horsfieldii, Butl. Trans. Zool. Soc., IX., p. 572 (1877).

,, *andamana*, Druce. Ent. Mo. Mag., XIX., p. 16 (1882).

Habitat.—Andamans; Singapore; Sumatra; Java; Lombok; Sambawa; Sumba; Amboina; Key Is.; New Guinea; Solomon Is.; New Hebrides; Queensland.

Subsp. *torenia*. Druce. Ent. Mo. Mag., XIX., p. 16 (1882).

Daphnis rosacea. Roths. Nov. Zool., I., p. 85 (1894).

Habitat.—Lifu; Fiji.

152. DEILEPHILA MINIMA.

Daphnis minima, Butl. Trans. Zool. Soc., IX., p. 573, pl. 92, f. 5 (1877).

,, *ernestina*, Moore Lep. Ceyl., III., p. 534, pl. 211, f. 1 (1887).

Habitat.—Bombay; Karwar; Ceylon.

Genus DAHIRA.

Type.

Dahira, Moore P. Z. S., 1888, p. 390 .... *rubiginosa.*

105. DAHIRA RUBIGINOSA.

Dahira rubiginosa, Moore P. Z. S., 1888, p. 391.

Ambulyx rubrescens, Butl. Ill. Het. B. M., VII., p. 26, pl. 121, f. 2.

Habitat.—PUNJAB.

Genus AMPELOPHAGA.

Ampelophaga, Brem. & Grey. Motsch. Et. Ent., I., p. 61 (1852) non descr. Butl. Pap. I, p. 104 (1881) .... *rubiginosa.*

A. Forewing without sharply marked greyish white lines.
  a. Abdomen and hindwing on underside bright rufous testaceous... *khasiána.*
  b. Abdomen and hindwing on underside salmon buff or clay colour .... *rubiginosa.*
B. Forewing with sharply marked greyish white lines...... *dolichoides.*

117. AMPELOPHAGA RUBIGINOSA.

Ampelophaga rubiginosa, Brem. & Grey. Motosch. Et. Ent., I, p. 61 (1852).

Deilephila romanovi, Staud. Rom. Mém., III., pl. 9, f. 1 a. b. (1887).

Acosmeryx ienobu. Holl. Trans. Am. Ent. Soc., XVI., p. 71 (1889).

Habitat.—AMURLAND ; JAPAN ; CHINA.

Subsp. *fasciosa*, Moore P. Z. S., 1888, p. 391.

Ampelophaga harterti, Roths. Iris. VII., p. 299 (1894).

Habitat.—PUNJAB ; ASSAM.

118*a.* AMPELOPHAGA KHASIANA.

Ampelophaga khasiana, Roths. Nov. Zool. II., p. 482 (1895).

Habitat.—W. CHINA, Moupin ; ASSAM, Khási and Jaintia Hills.

118. AMPELOPHAGA DOLICHOIDES.

Philampelus dolichoides, Feld. Reis. Nov., pl. 76, f. 8 (1874).

Habitat.—SIKHIM ; ASSAM.

Genus ELIBIA.

Type.

Elibia, Wlk., VIII., 148 (1856) .... *dolichus.*

159. ELIBIA DOLICHUS.

Sphinx dolichus, Westw. Cab. Or. Ent., p. 61, pl. 30, f. 1 (1848).

Habitat.—SIKHIM ; ASSAM ; PENANG ; SUMATRA ; NATUNA IS. ; BORNEO ; KALAWAN ; JAVA.

Genus ACOSMERYX.

Type.

Acosmeryx, Boisd. Spéc. Gén. Lép. Hét. I., p. 214 (1875) .... *anceus.*

A. Forewing with the grey subterminal line or band straight, extending to vein 1 .... *naga.*
B. Forewing with the grey subterminal line or band curved, ending at vein 4 or a little below it.

a. Fore and hindwing with the termen distinctly dentate.
  *a*¹. Forewing with the 1st postmedial line straight from vein 4 to 1, strong................................... *sericeus.*
  *b*¹. Forewing with the 1st postmedial line fine, interrupted... .... *omissa.*
b. Fore and hindwing with the termen not dentate.
  *a*¹. Hindwing on underside almost entirely ferruginous or vinaceous; forewing on upperside tawny, cinnamon or chestnut brown .... *anceus.*
  *b*¹. Hindwing on underside much shaded with olive-grey; forewing on upperside greyish olive .... *socrates.*

115. ACOSMERYX ANCEUS.

Sphinx anceus, Stoll. Cramer's Pap. Exot., IV., p. 124, pl. 355, f. A. (1781).
Zonilia mixtura, Wlk., XXXI. 34 (1861).
Enyo cinnamomea, Herr. Schäff Ausser. Eur. Schmett, f. 558 (1869).
Acosmeryx daulis, Boisd. Spec. Gén. Lép. Hét. I., p. 218 (1876).
Acosmeryx miskini, Kirby Trans. Ent. Soc., 1877, p. 234.
,, *cinerea,* Pag. Iris., I., p. 86 (1886).
Habitat.—AMBOINA; KEY IS.; TENIMBER; NEW GUINEA; TROBRIAND IS.; FERGUSSON I.; WOODLARK I.; QUEENSLAND.
Subsp. *subdentata,* Roths. Nov. Zool., IX., Suppl., p. 528 (1903).
Habitat.—SIKHIM; BHUTAN; ASSAM; SUMATRA; JAVA.

116.—ACOSMERYX NAGA.

Philampelus naga, Moore Cat. Lep. E. I. C., p. 271 (1857).
Acosmeryx Shervilli, Boisd. Spec. Gén. Lép. Hét., p. 217 (1875).
,, *metanaga,* Butl. A. M. N. H. (5), IV., p. 350 (1879).
Habitat.—JAPAN; PUNJAB; KUMAON; SIKHIM; BHUTAN.

116*a.* ACOSMERYX SERICEUS.

Philampelus sericeus, Wlk., VIII. 181 (1856).
Acosmeryx anceoides, Boisd. Spec. Gén. Lép. Hét. I., p. 216 (1875).
Habitat.—SIKHIM; BHUTAN; ASSAM; PHILIPPINES.

116*b.* ACOSMERYX OMISSA.

Acosmeryx omissa, Roths. Nov. Zool., IX., Suppl., p. 530 (1903).
Habitat.—SIKHIM; BHUTAN.

116*c.* ACOSMERYX SOCRATES.

Acosmeryx socrates, Boisd. Spec. Gén. Lép. Hét., I., p. 219 (1875).
,, *cinerea,* Butl. P. Z. S., 1875, p. 245.
Habitat.—SIKHIM; ASSAM; CEYLON; ANDAMANS; SUMATRA; BORNEO; JAVA.

Genus PANACRA.

Panacra, Wlk., VIII. 154 (1856.) — *Type.* *automedon.*

A. Forewing with the medial area green .... *busiris.*
B. Forewing with the medial area not green.

a. Forewing with the 3rd and 4th postmedial lines strongly dentate; patagia with golden metallic scales on upper edge .... *mydon.*

b. Forewing with the 3rd and 4th postmedial lines not strongly dentate towards inner margin.

  a^1. Forewing with the medial area pale, band-like...... *variolosa.*

  b^1. Forewing with the medial area not band-like; antemedial line indistinct.

    a^2. Hindwing with the terminal band dilated above middle.

      a^3. Hindwing on underside with the postmedial area tawny or ochreous, interrupted below costa.

        a^4. Forewing on underside with the double subterminal line extending to inner margin ...... *perfecta.*

        b^4. Forewing on underside with the double subterminal line dilated along vein 5 and conjoined to the 1st postmedial line .... *metallica.*

      b^3. Hindwing on underside with the postmedial area olive-brown towards costa..................... *sinuata.*

    b^2. Hindwing with the terminal band not dilated above middle.. *automedon.*

129. Panacra busiris.

Panacra busiris, Wlk., VIII. 158 (1856).

Habitat.—Sikhim; Assam; Annam; Nicobars; Borneo.

132. Panacra automedon.

Panacra automedon, Wlk., VIII. 154 (1856).
„ *truncata,* Wlk, 160 (1856).

Habitat.—Sikhim; Assam; Burma; Borneo; Java.

130. Panacra variolosa.

Panacra variolosa, Wlk. VIII. 156 (1856).
„ *vagans,* Butl. Ill. Het. B. M., V., p. 4, pl. 78, f. 7 (1881).
„ *hamiltoni,* Roths. Nov. Zool., I., p. 82 (1894).

Habitat.—Sikhim; Bhutan; Assam; Malacca; Siam; Borneo; Java.

131*a*. Panacra sinuata.

Panacra sinuata, Roths. Nov. Zool. IX., Suppl., p. 539 (1903).

Habitat.—Sikhim; Assam.

131. Panacra metallica.

Panacra metallica, Butl. P. Z. S., 1875, p. 6.

Habitat.—Sikhim; Bhutan.

131*b*. Panacra perfecta.

Panacra perfecta, Butl. P. Z. S., 1875, p. 391.

Habitat.—Sikhim; Bhutan.

133. Panacra mydon.

Panacra mydon, Wlk. VIII. 155 (1856).

Panacra scapularis, Wlk., VIII. 157 (1856).
Chærocampa jasion, Boisd. Spec. Gén. Lép. Hét. I., p. 282 (1875).
„ *arachtus,* Boisd. Spec. Gén. Lép. Hét. I., p. 282 (1875).
Panacra frena, Swinh. Cat. Lép. Hét. Mus. Oxon. I., p. 12, pl. 1, f. 5 (1892).
Habitat.—Sikhim; Bhutan; Assam; Burma; Tonkin.
Subsp. *elegantulus,* Herr. Schäff. Ausser. Eur. Schmett, f. 479 (1856).
Panacra regularis, Butl., P. Z. S., 1875, p. 247.
„ *variegata,* Roths. Nov. Zool. I., p. 81 (1894).
„ *perakana,* Roths. Nov. Zool. I., p. 81 (1894).
Habitat.—Penang; Perak; Borneo; Philippines; Java; Lombok; Sumbawa; Sumba.

Genus Angonyx.

Type.
Angonyx, Boisd. Spec. Gén. Lép. Hét. I., p. 317 (1875)...... *testacea.*
160. Angonyx testacea.
Angonyx testacea, Wlk., VIII., 102 (1856).
Tylognathus emus, Boisd. Spéc. Gén. Lép. Hét. I., p. 294 (1875).
Angonyx emilia, Boisd. Spec. Gén. Lép. Hét. I., p. 318, pl. 8, f. 1 (1875).
Panacra ella, Butl. P. Z. S., 1875, p. 246.
Habitat—Assam; Khasis; Nilgiris; Ceylon; Java; Amboina.
Subsp. *papuana,* Roths. Nov. Zool. IX., Suppl., p. 544 (1903).
Habitat.—Queensland.

Genus Enpinanga.

Type.
Enpinanga, Roths. Nov. Zool., IX., Suppl., p. 545 (1903) ... *vigens.*
134. Enpinanga assamensis.
Panacra assamensis, Wlk., VIII. 160 (1856).
Habitat.—Assam; Khasis.

Genus Rethera.

Type.
Rethera, Roths. Nov. Zool., IX., Suppl., p. 547 (1903) .... *komarovi.*
160*a*. Rethera komarovi.
Deilephila komarovi, Christ. Rom. Mém. II., p. 169, pl. 15, f. 2 (1885).
Chærocampa stipularis, Swinh. Trans. Ent. Soc., 1885, p. 346, pl. 9, f. 1.
Habitat.—Asia Minor; Transcaucasia; Afghanistan.

Genus Cizara.

Type.
Cizara, Wlk., VIII. 120 (1856) .... *ardeniæ.*
Abrisa, Kirby Cat. Lép. Hét., I., p. 641 (1892) .... *sculpta.*

161. CIZARA SCULPTA.

Microlophia sculpta, Feld. Reis Nov., pl. 75, f. 9 (1874).

Habitat.—BOMBAY, Canara ; SIAM.

Genus NEPHELE.

	Type.
Nephele, Hübn. Verz., p. 133 (1827)	*didyma.*
Zonilia, Wlk., VIII. 192 (1856)	*funebris.*

172. NEPHELE DIDYMA.

Sphinx didyma, Fabr. Syst. Ent., p. 543 (1775).

Nephele hespera, Fabr. Syst. Ent., p. 546 (1775).

Sphinx chiron, Cram. Pap. Exot. II., p. 62, pl. 137, f. E. (1777).

„ *morpheus*, Cram. Pap. Exot. II., p. 84, pl. 149, f. D. (1777).

„ *quaterna*. Charp. Esp. Schmett., pl. 1, f. 2 (1830).

Perigonia obliterans, Wlk., XXXI, 28 (1864).

Habitat.—PUNJAB ; SIKHIM ; BOMBAY ; MADRAS ; CEYLON ; BURMA ; PENANG ; JAVA.

Genus GURELCA.

	Type.
Gurelca, Kirby Cat. Lép. Hét. I., p. 643 (1892)	*hyas.*
A. Hindwing with the terminal band of even width	*hyas.*
B. Hindwing with the terminal band narrowing to tornus	*masuriensis.*

173. GURELCA HYAS.

Lophura hyas, Wlk., VIII. 107 (1856).

Macroglossum geometricum, Moore Lép. E. I. C., p. 265 (1857).

Perigonia macroglossoides, Wlk., XXXV. 1851 (1866).

Habitat.—FORMOSA ; PUNJAB ; SIKHIM ; ASSAM ; BOMBAY ; MADRAS ; PHILIPPINES ; JAVA.

174. GURELCA MASURIENSIS.

Lophura masuriensis, Butl. P. Z. S., 1875, p. 244, pl. 36, f. 3.

„ *himachala*, Butl. P. Z. S., 1875, p. 621.

„ *erebina*, Butl. P. Z. S., 1875, p. 621.

Habitat.—PUNJAB ; SIKHIM ; BHUTAN ; ASSAM ; BURMA.

Subsp. *sangaica*, Butl. P. Z. S., 1875, p. 621.

Habitat.—JAPAN ; COREA ; CHINA.

(*To be continued.*)

THE BIRDS OF TRAVANCORE.

By H. S. Fergusson, F.L.S.

WITH NOTES ON THEIR NIDIFICATION.

By T. F. Bourdillon, F.L.S.

Part II.

(*Continued from page* 474.)

Order PICI.

Family Picidæ.

Sub-family *Picinæ*.

(137) Gecinus striolatus.—The Little Scaly-bellied Green Woodpecker.

Blanford, No. 948 ; *Jerdon, No.* 171.

I have only lately obtained two specimens of this bird, both in the low country—one at Cape Comorin in January 1902 and another at Quilon at the beginning of 1903.

(138) Gecinus chlorogaster.—The South-Indian Yellow-naped Woodpecker.

Blanford, No. 952 ; *Jerdon, No.* 175.

Fairly common in the hills at moderate elevations. I have nothing to add to Mr. F. W. Bourdillon's description "not noisy except during the breeding season. In February and March the plaintive monotonous call of these birds (which somewhat resembles the breeding call of the common pariah kite) may be heard at all hours of the day, as they cling motionless to the topmost bough of some tall forest tree."

(139) Liopicus mahrattensis.—The Yellow-fronted Pied Woodpecker.

Blanford, No. 972 ; *Jerdon, No.* 160.

This Woodpecker is by no means common. There are two specimens only in the Museum taken in or near Trevandrum.

(140) Iyngipicus gymnophthalmus.—The Ceylon Pigmy Woodpecker.

Blanford, No. 977 ; *Hume, No.* 164 *bis*.

This bird is found in forest, both in the low country and up to 2,000 feet on the hills. It frequents the tops of tall trees and utters a long thrilling note.

(141) Micropternus gularis.—The Malabar Rufous Woodpecker.
Blanford, No. 985; *Jerdon, No.* 179.

I have only seen this bird in the low country and at the foot of the hills; so far as I am aware, it does not ascend them.

(142) Brachypternus aurantius.—The Golden-backed Woodpecker.
Blanford, No. 986; *Jerdon, No.* 180.

Common in the plains; its loud harsh cry is a familiar sound in and about Trevandrum.

(143) Tiga javanensis.—The Common Golden-backed Three-toed Woodpecker.
Blanford, No. 988; *Jerdon, No.* 185.

This bird is very common in the hills at all elevations. Mr. T. F. Bourdillon writes: "I was fortunate enough to obtain a clutch of eggs of this bird in March, having observed the female boring indefatigably a dead branch. I may note that the most certain way of discovering the nests of Woodpeckers is by noting where a bird is working for a long time together in the breeding season. A little practice will enable an observer to know whether the Woodpecker is boring a nest or simply hunting for insects. The nest was in a hole in a mango tree (*Mangifera indica*) about 30 feet from the ground and at an elevation of 3,000 feet. Since then I have found other nests at elevations from 2,000 to 3,000 feet, but have never got the eggs. The eggs are two in number and quite white.

(144) Chrysocolaptes gutticristatus.—Tickell's Golden-backed Woodpecker.
Blanford, No. 992; *Jerdon, No.* 166.

Mr. F. W. Bourdillon records this as "inhabiting the lower ranges of forest." It is certainly not confined to them, as I have shot it at 3,000 feet and also at 6,000 feet on the High Range, generally in the neighbourhood of streams.

(145) Hemicercus canente.—The Heart-spotted Woodpecker.
Blanford, No. 995; *Jerdon, No.* 165.

This little Woodpecker may be found in forest, both in the low country and on the hills. They generally go about in pairs. They draw one's attention at once by their loud call. Mr. T. F. Bourdillon writes:

"This Woodpecker excavates a nest out of dead wood, boring into the dead branch of a living tree or choosing a dead tree. Like all woodpeckers, it never makes use of the same nest again. I have never been able to obtain the eggs. They breed in February."

(146) THRIPONAX HODGSONI.—The Malabar Great Black Woodpecker.

Blanford, No. 997; *Jerdon, No.* 169.

This is eminently a forest bird and may be found on the hills from 500 to 3,000 feet, going about in pairs. Where there is coffee or tea cultivation it usually disappears—not that it is a shy bird, but because of the wholesale destruction of the forests. In the cardamom hills, where the forests are only thinned and the undergrowth removed to make room for cardamoms, they are fairly common, and they may be heard calling to each other as they fly from tree to tree.

(147) PICUMNUS INNOMINATUS.—The Speckled Piculet.

Blanford, No. 1001; *Jerdon, No.* 186.

I have only shot one specimen of this bird on the hills in South Travancore at an elevation of 4,000 feet in dense forest. I saw one other specimen on the same day. Both were on living trees.

(148) THEREICERYX ZEYLONICUS.—The Common Indian Green Barbet.

Blanford, No. 1008; *Jerdon, No.* 193.

This Barbet is not common in the low country. I once shot one at 4,000 feet elevation in the hills.

(149) THEREICERYX VIRIDIS—The Small Green Barbet.

Blanford, No. 1010; *Jerdon, No.* 194.

This is a very common bird, both in the low country and on the hills at all elevations. "The eggs of this Barbet are extremely difficult to obtain as the bird invariably chooses a dead tree in which to bore a hole for its nest. Sometimes these trees are of great growth and defy any attempts to climb them; at others they are too slight to bear the weight of a man, and though I have seen dozens of nests and had young birds brought to me, I have never been able to get the eggs. The birds never use the nests again, but frequently return to the same tree, and as they often give up boring holes which they have commenced, it is not an unusual thing to see a tree with ten or fifteen holes in it. The breeding season extends from March to May.—*T. F. B.*"

(150) XANTHOLÆMA HÆMATOCEPHALA.—The Crimson-breasted Barbet.

Blanford, No. 1019; *Jerdon, No.* 197.

The Coppersmith is very common throughout the low country and at times may be found on the hills up to 1,500 feet elevation. "It breeds at elevations of 500 to 1,500 feet, and I once obtained a couple of eggs in March from a hole in a tree at 1,500 feet elevation, not far from Courtallum. The eggs were quite white and averaged 1·0 × ·66.—*T. F. B.*"

(151) XANTHOLÆMA MALABARICA—The Crimson-throated Barbet.

Blanford, No. 1020 ; *Jerdon, No.* 918.

Mr. F. W. Bourdillon writes of this bird: "This species is very common throughout the low country, and during the hot weather ascends the lower slopes of the hills. Its call, as Jerdon mentions, is similar to that of the Crimson-breasted Barbet (*X. hæmatocephala*), but the two are easy to be distinguished from each other."

This is quite a mistaken description, and Mr. Bourdillon must have been misled by hearing the notes of the Coppersmith. The Crimson-throated Barbet is certainly a forest bird and is confined to the hills. I have not met with it in the low country, and my collector, though repeatedly sent to look for it, never secured a single specimen. Mr. W. Ogilvie Grant informs me that there is no specimen in the Hume collection in the British Museum sent by Mr. Bourdillon, but there is one from the Cardamom Hills, sent by Mr. T. Elwes. I should therefore describe it as a rare bird found only in forest on the hills.

ORDER ANISODACTYLI.

Sub-order CORACLÆ.

Family *Coraciadæ.*

(152) CORACIAS INDICA.—The Indian Roller.

Blanford, No. 1022 ; *Jerdon, No.* 123.

The Indian Roller is found only in the low country. It often haunts a particular spot, but it is nowhere very common, except perhaps at Cape Comorin, where in July 1901 there were a good number, and again in the same locality in December of that year. It is not found in forest nor on the hills.

(153) EURYSTOMUS ORIENTALIS.—The Broad-billed Roller.
Blanford, No. 1025; *Jerdon, No.* 126.

This is eminently a forest bird. I have only secured a single specimen in forest land, near Koni, at an elevation of about 300 feet. Mr. T. F. Bourdillon writes: "The Broad-billed Roller is a very remarkable bird and comes to us to breed, leaving Travancore again before the commencement of the monsoon. Pairs of these birds may be seen here and there throughout the length of the hills at elevations from 500—3,000 feet, any time between September and the end of April; but they are by no means common, though their curious chattering cry and eccentric flight attract attention at once. Their nests are placed in holes of trees at about 30—40 feet from the ground, and contain three white eggs, varying considerably in size and shape."

Sub-order MEROPES.

Family *Meropidæ.*

(154) MEROPS VIRIDIS.—The common Indian Bee-eater.
Blanford, No. 1026; *Jerdon, No.* 117.

This is one of the commonest and most numerous birds in the low country.

(155) MEROPS PHILIPPINUS.—The Blue-tailed Bee-eater.
Blanford, No. 1027; *Jerdon, No.* 118.

This is a rare bird, and the Museum contains only one specimen shot near Trevandrum in August 1893.

(156) MELITTOPHAGUS SWINHOII.—The Chestnut-headed Bee-eater.
Blanford, No. 1030; *Jerdon, No.* 119.

This Bee-eater is confined to the hills, where it is not uncommon in North Travancore about Pirmerd and the High Range. Breeds in February.

(157) NYCTIORNIS ATHERTONI.—The Blue-bearded Bee-eater.
Blanford, No. 1031; *Jerdon, No.* 122.

I have never come across this bird myself, but the Museum possesses some skins labelled Travancore, so I include it in my list.

(158) CERYLE VARIA.—The Indian Pied Kingfisher.
Blanford, No. 1033; *Jerdon, No.* 136.

Common along the backwaters.

(159) Alcedo ispida.—The Common Kingfisher.
Blanford, No. 1035 ; *Jerdon, No.* 134.

Common about the backwaters everywhere and also about tanks and ponds in the low country, but does not ascend the hills. Breeds in March.

(160) Alcedo beavani.—Beavan's Kingfisher.
Blanford, No. 1036 ; *Hume, No.* 135 *bis.*

This bird is only found in the neighbourhood of the streams at the foot of the hills, where it is not uncommon.

(161) Pelargopsis gurial.—The Brown-headed Stork-billed Kingfisher.
Blanford, No. 1043 ; *Jerdon, No.* 127.

Like the last, confined to the low country, forest and the foot of the hills, where it may occasionally be found, though it is nowhere abundant. It frequents forest streams. Eggs of this bird, measuring 1·5 by 1·13, were brought to Mr. Bourdillon by hillmen in April.

(162) Halcyon smyrnensis.—The White-breasted Kingfisher.
Blanford, No. 1044 ; *Jerdon, No.* 129.

This is about the commonest of the Kingfishers, and does not frequent the neighbourhood of streams only, but may be found in compounds well away from water. It is easily kept in captivity. It does not ascend the hills. "I have more than once had the eggs of this Kingfisher brought to me by the hillmen, who told me the usual number of eggs is five, and that the nest is always placed in a hole on a river bank. The eggs are quite white, rather glossy and spherical.—*T. F. B.*" Breeds in April.

(163) Halcyon pileata.—The Black-capped Kingfisher.
Blanford, No. 1045 ; *Jerdon, No.* 130.

This is a rare bird ; one specimen only was brought to me alive, having been captured in a well in Trevandrum.

Sub-order Bucerotes.

Family *Bucerotidæ.*

(164) Dichoceros bicornis.—The Great Hornbill.
Blanford, No. 1051 ; *Jerdon, No.* 140.

Not common, but very much in evidence when present. It is found throughout the range. In captivity it is fearless and can hold its own with most dogs. It will eat rats readily. Having killed a rat, the bird passes it across and back between its mandibles, and when it is thus sufficiently elongated and soft, it tosses it up and swallows it at one gulp. The casque is not fully formed till nearly a year after the bird is hatched.

" Breeds in the holes of large forest trees, at a height of 30—50 feet from the ground, returning year after year to the same tree. It seems pretty well ascertained now that the female plasters herself up in the nest when she begins to incubate the eggs, and remains there till the young one is hatched, depending all the time on the male for food. During this time single birds alone are seen, and the nest may with a little difficulty be found by observing where the male returns when he has collected a sufficient quantity of food for his mate. I was shewn a nest in February which the birds were preparing, but they subsequently deserted it as a coffee clearing had been made close by, and they seemed disturbed by such noises as the barking of dogs or the shouting of coolies. In the beginning of March I was fortunate enough to obtain an egg; it was of a very rough texture, and was no doubt originally white, but when I got it the egg was stained quite brown. The size of the egg was 2·5 × 1·79.—*T. F. B.*"

(165) ANTHRACOCEROS CORONATUS.—The Malabar Pied Hornbill.

Blanford, No. 1052 ; *Jerdon, No.* 141.

This bird is by no means common, but is locally distributed in forest land at the foot of the hills. The Museum possesses only one specimen shot about nine miles from Trevandrum.

(166) LOPHOCEROS GRISEUS.—The Malabar Grey Hornbill.

Blanford, No. 1063 ; *Jerdon, No.* 145.

This Hornbill is said by Blanford not to ascend the hills of Southern India above about 3,000 feet. It is commonest at this elevation, especially on the Cardamom Hills, but I have shot it at over 5,000 feet on the High Range and at 4,000 feet at Chimanji in South Travancore.

Sub-order UPUPÆ.

Family *Upupidæ*.

(167) UPUPA INDICA.—The Indian Hoopoe.

Blanford, No. 1067 ; *Jerdon, No.* 255.

The Hoopoe is commonest in the drier regions of the south in the low country. During the hot weather about March it may be found in the hills even ascending the High Range.

ORDER MACROCHIRES.

Sub-order CYPSELI.

Family *Cypselidæ.*

Sub-family *Cypselinæ.*

(168) CYPSELUS MELBA.—The Alpine Swift.

Blanford, No. 1068 ; *Jerdon, No.* 98.

I have only shot these birds on the High Range, where they may be seen in numbers hawking insects through the smoke wherever the grass is being burnt.

(169) CYPSELUS AFFINIS.—The Common Indian Swift.

Blanford, No. 1073 ; *Jerdon, No.* 100.

I have not come across this Swift myself, but my collectors found a colony breeding in January 1903 in the registrar's office in North Parur in North Travancore. They are looked upon as sacred, and permission had to be obtained to take specimens with their nests and eggs.

(170) TACHORNIS BATASSIENSIS.—The Palm-Swift.

Blanford, No. 1075 ; *Jerdon, No.* 102.

This little Swift is very abundant in South Travancore, where the fan-palm takes the place of the cocoanut. A few may be met with about Trevandrum also. They utter a feeble twittering sound when on the wing.

" They breed from February to June. I have had the eggs brought to me more than once. They are pure white and decidedly pointed, being, like all eggs belonging to this genus, semi-transparent.— *T. F. B.*"

(171) CHÆTURA INDICA.—The Brown-necked Spine-tail.

Blanford, No. 1078 ; *Jerdon, No.* 96.

This fine Swift is not uncommon on the hills, where, however, they are more often heard than seen, as their flight is so swift that you hear only a rushing sound ordinarily, but at times they seem to play and the flight is then moderated. I only once got a really good chance of getting specimens in March 1903; I found them in numbers playing in this way in open ground at Chimanji at an elevation of 4,000 feet and was able to secure several.

" Breeds in April and May as I observed one of them flying with a straw in its mouth at the beginning of the former month, but whether it breeds within Travancore or not I do not know as their power of flight is so enormous. It seems however probable.—*T. F. B.*"

(172) Collocalia fuciphaga—The Indian Edible-nest Swiftlet.
Blanford, No. 1081 ; *Jerdon, No.* 103.

Common on the hills, where it is a resident. " Breeds abundantly throughout the hills of Travancore, sometimes in small colonies of four or five pairs and sometimes in larger colonies of as many hundreds. The nest is formed of moss stuck together with a gelatinous substance which often covers the whole of the interior of the nest, and with which it is securely attached to the rock. They are often so thickly placed together that it is very difficult to detach one of them without bringing away two or three others. The largest breeding place I know of is a cave situated at the base of a grass ridge at an elevation of about 2,300 feet in South Travancore. The greater number of the nests there when I visited it in March contained two pointed oval white eggs."

(173) Macropteryx coronata.—The Indian Crested Swift.
Blanford, No. 1086 ; *Jerdon, No.* 104.

This Swift is by no means common ; the Museum contains a few specimens without locality, and I have only once had one brought to me by my collector.

(174) Caprimulgus asiaticus.—The Common Indian Nightjar.
Blanford, No. 1091 ; *Jerdon, No.* 112.

The Common Indian Nightjar, or Ice-bird, is very common in the low country throughout Travancore.

(175) Caprimulgus macrurus.—Horsfield's Nightjar.
Blanford, No. 1093 ; *Jerdon, No.* 111.

I have only received two specimens of this bird, which were both shot on the High Range. I do not think it occurs in South Travancore.

(176) Caprimulgus indicus.—The Jungle Nightjar.
Blanford, No. 1095 ; *Jerdon, No.* 107·108.

Mr. F. W. Bourdillon describes this Nightjar as " a winter visitor, occurring rather abundantly from November to March and preferring open grass land at the edge of forest." I think this is incorrect as regards the whole range. It is a winter visitor to the lower slopes of the hills, not during May, and later it is to be found on the High Range, and as in Ceylon, as described by Colonel Legge, " it appears to leave these high regions for warmer districts during the cold nights of the opposite season."

" The nest of this very common bird, if it deserves the name, is merely a depression in the ground with possibly a few feathers to form a lining ;

here it lays two eggs of a beautiful salmon colour indistinctly blotched and streaked with grey and darker salmon. The eggs are peculiarly cylindrical, either end being top or bottom. The breeding season extends from January to March.

The average of several eggs is 1·1 × ·8.—*T. F. B.*"

(177) LYNCORNIS CERVINICEPS.—The Great-eared Nightjar.
Blanford, No. 1096 ; *Hume, No.* 114 *ter.*

This fine Nightjar is not uncommon about the foot of the hills in forest usually near water. They come out shortly after sunset and may be seen in flocks hawking.

Sub-order PODARGI.

Family *Podargidæ.*

(178) BATRACHOSTOMUS MONILIGER.—The Ceylonese Frogmouth.
Blanford, No. 1099 ; *Jerdon, No.* 105.

This is a difficult bird to obtain as it is entirely nocturnal and frequents dense jungle. There is only one specimen in the Museum.

" It breeds at elevations of 2,000—3,000 feet from January to the end of February. My brother is the only person who has ever succeeded in getting the nest of this very extraordinary bird with the young bird, but since then I have picked up the curious pad which forms the nest, though I should never have known what it was without seeing the other. The first nest was taken on 24th February and contained a young bird of about ten days' old. Beneath the tree, which was a small sapling, were the remains of a white egg, evidently belonging to the above-mentioned nest. The latter was placed in a fork about 12 feet from the ground, and was an almost flat pad 3 inches in diameter, by nearly an inch in thickness, composed of a sort of felt which was really the bird's down combined with moss, leaves, and small twigs.—*T. F. B.*"

ORDER TROGONES.

Family TROGONIDÆ.

(179) HARPACTES FARCIATUS.—The Malabar Trogon.
Blanford, No. 1100 ; *Jerdon, No.* 115.

Not uncommon in heavy forest from 1,000 feet upwards. A solitary bird whose presence is often advertised by the low mewing sound it utters.

" It is very shy and retiring, keeping entirely to thick jungle, and owing to this habit its nest and eggs are very rarely met with. I

found one in March at an elevation of 2,100 feet at the edge of a thick jungle. It was placed at the top of a stump about 6 feet from the ground, and consisted simply of a few chips of rotten wood at the bottom of a hollow four inches deep which the bird had dug out of the stump. Here there lay two white eggs with the very slightest tinge of coffee colour, very glossy and round—indeed they in all respects resembled balls of rather old ivory. The eggs were 1·075 × ·83
1·0 × ·92 —*T. F. B.*”

Order COCCYGES.

Family Cuculidæ.

Sub-family *Cuculinæ.*

(180) Cuculus canorus.—The Cuckoo.

Blanford, No. 1104 ; *Jerdon, No.* 199.

A rare winter visitor. The Museum has one specimen, shot in Trevandrum in February 1893.

(181) Cuculus micropterus.—The Indian Cuckoo.

Blanford, No. 1107 ; *Jerdon, No.* 203.

The Museum contains two specimens only of this Cuckoo, both shot in the low country, one in February and one in May. I have never met with it in the hills. It frequents forest, and its loud cry may be heard in April and May, especially towards dusk.

(182) Hierococcyx varius.—The Common Hawk-Cuckoo.

Blanford, No. 1109 ; *Jerdon, No.* 205.

This is a very common bird in the low country and about the foot of the hills. I have only once seen one at 2,000 feet elevation ; it usually keeps to the lower slopes. It is a resident and throughout the hot weather (March to May) its exasperating cry may be heard by night as well as by day. In Travancore it goes by the name of the Brain-fever bird.

(183). Cacomantis Passerinus.—The Indian Plaintive Cuckoo.

Blanford, No. 1112 ; *Jerdon, No.* 208.

The Museum possesses only two specimens of this Cuckoo, both shot in April in forest in the low country. I know nothing of its habits.

(184) Penthoceryx sonnerati.—The Banded Bay Cuckoo.

Blanford, No. 1114 ; *Jerdon, No.* 202.

This bird is said to be common in the forests near the Malabar Coast. This does not apply to Travancore, where it is decidedly rare.

(185) Surniculus lugubris.—The Drongo Cuckoo.

Blanford, No. 1117 ; *Jerdon, No.* 210.

The Drongo Cuckoo is not uncommon in the low country in South Travancore, where it may be found in open forest land. I believe it is a resident.

(186) Coccystes jacobinus.—The Pied Crested Cuckoo.

Blanford, No. 1118 ; *Jerdon, No.* 212.

This fine Cuckoo is a resident and is fairly common in the low country, more especially in the extreme south, frequenting low scrub and open country where there are bushes. It is usually found singly.

(187) Coccystes coromandus.—The Red-winged Crested Cuckoo.

Blanford, No. 1119 ; *Jerdon, No.* 213.

This bird is a rare visitor to the hills in winter. The Museum possesses two specimens, shot at 2,500 and 4,000 feet respectively, in South Travancore.

Sub-family *Phœnicophainæ*.

(188) Eudynamis honorata.—The Indian Koel.

Blanford, No. 1120 ; *Jerdon, No.* 214.

The Koel is not a very common bird in Travancore. It is resident and may be found occasionally in the hills as well as in the low country.

(189) Rhopodytes viridirostris.—The Small Green-billed Malkoha.

Blanford, No. 1122 ; *Jerdon, No.* 216.

Not uncommon about the foot of the hills in open forest. It is said not to ascend the hills, but I have shot it at Pirmerd at 3,000 feet elevation.

(190) Taccocua leschenaulti.—The Sirkeer Cuckoo.

Blanford, No. 1129 ; *Jerdon, No.* 219.

This is a rare bird. The Museum has only one specimen, taken in the low country.

(191) Centropus sinensis.—The Common Coucal or Crow-Pheasant.

Blanford, No. 1130 ; *Jerdon, No.* 217.

Very abundant in the low country and about the foot of the hills. Travancore birds have the inter-scapulars black.

Mr. Bourdillon writes that he has had the eggs of this bird brought to him in June and in August, but has not taken the nest himself.

(192) Centropus bengalensis.—The Lesser Coucal.
Blanford, No. 1133 ; *Jerdon, No.* 218.

Not uncommon in the hills, where it frequents grass land.

Order PSITTACI.

(193) Palæornis torquatus.—The Rose-ringed Paroquet.
Blanford, No. 1138 ; *Jerdon, No.* 148.

Very common throughout the low country. Breeds in February and March.

(194) Palæornis cyanocephalus.—The Western Blossom-headed Paroquet.
Blanford, No. 1139 ; *Jerdon, No.* 149.

Common in the low country wherever there is forest, and also at the foot of the hills, which it does not ascend. Breeds in March.

(195) Palæornis columboides.—The Blue-winged Parequet.
Blanford, No. 1143 ; *Jerdon, No.* 151.

Common on the hills not ascending above 3,000 feet in the south, but found at 5,000 feet elevation on the High Range. "Towards the end of the year shrieking flocks of paroquets, which abound at elevations of 1,500 to 3,000 feet, pair off and begin to select sites for their future homes. The site chosen is invariably a hole in a tree, usually the Iron-wood tree (*Mesua ferrea*) at a height of from 16—100 feet from the ground. Here the eggs, usually four in number, are deposited in January or the beginning of February. The eggs are pure white, rather rough and decidedly thick for their size. There is no attempt at a nest, the eggs being simply laid on the bare wood, which may sometimes be a little smoothed for their reception, and the same hole is frequently used again. The average of seven eggs is 1·08 × ·88. —*T. F. B.*"

(196) Loriculis vernalis.—The Indian Loriquet.
Blanford, No. 1150 ; *Jerdon, No.* 153.

Common on the hills, descending to lower elevations than the last. Breeds in March and April.

"One nest I found was at the top of a hollow stump over which a creeper was growing, which formed a sort of cover. It was about 15 feet from the ground and contained three very hard set eggs, white and not glossy. This was at an elevation of 2,000 feet. The eggs averaged ·73 × ·58—*T. F. B.*"

ORDER STRIGES.

Family STRIGIDÆ.

(197) STRIX FLAMMEA.—The Barn-owl or Screech-owl.

Blanford, *No.* 1152 ; *Jerdon*, *No.* 60.

The Barn-owl is found occasionally in the low country about human habitations. It breeds in December and January.

Family ASIONIDÆ.

Sub-family *Asioninæ*.

(198) ASIO ACCIPITRINUS.—The Short-eared Owl.

Blanford, *No.* 1157 ; *Jerdon*, *No.* 68.

I have never come across this bird. Mr. F. W. Bourdillon shot a single specimen " while hawking at mid-day in bright sunshine at 4,000 feet elevation in the end of December."

(199) SYRNIUM OCELLATUM.—The Mottled Wood-owl.

Blanford, *No.* 1161 ; *Jerdon*, *No.* 65.

Two specimens were shot by my collectors at Perumbalam, an island in the Verubanad lake, in January 1903. The contents of their stomachs consisted of crabs and beetles. It is fairly common from Arukkutty to Vycome. Eggs of this bird were brought to Mr. Bourdillon by the hillmen in June.

Sub-Family *Buboninæ*.

(200). KETUPA ZEYLONENSIS.—The Brown Fish-owl.

Blanford, *No.* 1164 ; *Jerdon*, *No.* 72.

Common in forest land in the low country near the sea coast. Breeds in March and April. The Public Gardens possess specimens that have been ten years in captivity.

(201). HUHUA NEPALENSIS.—The Forest Eagle-owl.

Blanford, *No.* 1170 ; *Jerdon*, *No.* 71.

This grand bird is not common. Two specimens, taken alive in the low country in forest, lived for some years in the Public Gardens. Another was shot on the High Range and presented to the Museum.

(202). SCOPS BAKKAMŒNA.—The Collared Scops-owl.

Blanford, *No.* 1178 ; *Jerdon*, *No.* 75.

A very common bird throughout the low country. It does not ascend the hills.

(203) ATHENE BRAMA.—The Spotted Owlet.

Blanford, No. 1180 ; *Jerdon, No.* 76.

Another very common bird in the low country, especially so at Cape Comorin, where numbers may be met with in the old ruins of the fortified "Travancore Lines." Breeds in March and April. It does not ascend the hills. Eggs taken by hillmen were brought to Mr. Bourdillon in April. They measure 1¼ × 1⅛.

(204) GLAUCIDIUM RADIATUM.—The Jungle Owlet.

Blanford, No. 1184 ; *Jerdon, No.* 77.

This owlet is common both in the low country and the lower slopes of the hills, sometimes ascending them as high as 2,500 feet. It breeds in April.

(205) NINOX SCUTULATA.—The Brown Hawk-owl.

Blanford, No. 1187 ; *Jerdon, No.* 81.

Not uncommon in the hills at about 2,000 to 2,500 feet elevation. Occurs also in forest land in the low country. Its cry is a sort of double hoot. This can be easily imitated, and the birds will answer and be attracted by calling them in this way. Eggs of this bird were brought to Mr. Bourdillon by the hillmen in February. They measure 1⅜ × 1¼.

ORDER ACCIPITRES.

Family PANDIONIDÆ.

(206) PANDION HALIÆTUS.—The Osprey.

Blanford, No. 1189 ; *Jerdon, No.* 40.

A cold weather visitor to the lakes near the coast, where specimens may not uncommonly be seen dropping into the water from time to time, causing a great commotion.

Family VULTURIDÆ.

(207) OTOGYPS CALVUS.—The Black Vulture or Pondicherry Vulture.

Blanford, No. 1191 ; *Jerdon, No.* 2.

A single specimen of this fine vulture was sent to me alive from Colasagram, a locality close to the hills in South Travancore.

(208) GYPS INDICUS.—The Indian Long-billed Vulture.

Blanford, No. 1194 ; *Jerdon, No.* 4.

This is apparently a rare bird ; a live specimen was brought from Nagercoil, and this is the only locality where it has been obtained in Travancore.

(209) PSEUDOGYPS BENGALENSIS—The Indian White-backed Vulture.

Blanford, No. 1196 ; *Jerdon, No.* 5.

This is the only vulture that is common in Travancore, where it may be found both in the low country and on the hills.

" Breeds in colonies, building its nest, a huge pile of sticks, in trees, and often at no great height from the ground. A colony of these birds used to build regularly every year in a bit of forest adjoining Oliver's estate in the Ashamboo hills in South Travancore, but since the forest has been cleared for coffee they have entirely deserted it. The breeding season in Travancore is from February to April.—*T. F. B.*"

(210) NEOPHRON GINGINIANUS.—The Smaller White Scavenger Vulture.

Blanford, No. 1197 ; *Jerdon, No.* 6.

I have only met with this bird in the dry district in the extreme south where it is common about Nagercoil.

Family FALCONIDÆ.

Sub-family *Falconinæ.*

(211) HIERÆTUS PENNATUS.—The Booted Eagle.

Blanford, No. 1208 ; *Jerdon, No.* 31.

An occasional winter visitor. The Museum possesses only one specimen, shot in Trevandrum in February.

(212) LOPHOTRIORCHIS KIENERI.—The Rufous-bellied Hawk Eagle.

Blanford, No. 1209 ; *Jerdon, No.* 37.

A rare bird. Mr. F. W. Bourdillon had one given to him by a friend who shot it at an elevation of 2,200 feet while in the act of swooping at a chicken. Mr. Bourdillon further says :—"Not long after obtaining this specimen an eagle flew past me, while I was riding, which, from its deep chestnut-coloured belly, I have no doubt belonged to this same species."

I shot one at the foot of the hills in South Travancore in April 1901.

(213) ICTINÆTUS MALAYENSIS.—The Black Eagle.

Blanford, No. 1210 ; *Jerdon, No.* 32.

A fairly common bird and resident. It may be seen soaring just above the tops of the trees from 500 feet elevation upwards throughout the hills extending to the High Range. " Breeds on cliffs at elevation of 2,000 feet and upwards. I once found the nest of these birds on the ledge of a cliff of no very great height, but the nest was in such a position that, though I got very near it, I was unable quite to reach it. The birds breed in January and February, and lay from one to three eggs, which are greyish white, sometimes sparingly, sometimes profusely, blotched and mottled with brownish red.

The eggs average 2·6 × 1·95 inches.—*T.F.B.*"

(214) SPIZÆTUS CIRRHATUS.—The Crested Hawk Eagle.
Blanford, No. 1211 ; *Jerdon, No.* 35.

Common in the low country, less so on the hills. It is very destructive to poultry, as it takes its station on the top of a high tree, and day after day, unless hunted away, will swoop down and carry off a fowl. Breeds in March.

(215) SPIZÆTUS KELAARTI.—Legge's Hawk Eagle.
Blanford, No. 1214.

Found only on the hills, and that rarely. I have never shot one, but Mr. Bourdillon got two specimens at 2,500 feet elevation.

(216) SPILORNIS CHEELA.—The Crested Serpent Eagle.
Blanford, No. 1217 ; *Jerdon, No.* 39.

Fairly common in the low country and also on the hills. Two have lived in captivity in the Public Gardens in Trevandrum for some years. They feed readily on raw meat.

(217) BUTASTUR TEESA.—The White-Eyed Buzzard-Eagle.
Blanford, No. 1220 ; *Jerdon, No.* 39.

This bird is said to be rare in Southern India. This is not so as regards South Travancore, where it is not uncommon in the low country but does not ascend the hills.

(218) HALIASTUR INDUS.—The Brahminy Kite.
Blanford, No. 1228 ; *Jerdon, No.* 55.

Common all over the low country and occasionally found in the hills during the hot season. Breeds in January and February.

(219) MILVUS GOVINDA.—The Common Pariah Kite.
Blanford, No. 1229 ; *Jerdon, No.* 56.

Abundant in the low country and common in the hills during the hot season. Breeds usually during February and March.

(220) ELANUS CÆRULEUS.—The Black-winged Kite.
Blanford, No. 1232 ; *Jerdon, No.* 59.

I believe this to be only a winter visitor. One specimen was shot in Trevandrum in March. Another I saw in open grass land at Sastamcotta in the low country near Quilon, also in March. It was hovering like a Kestril, stooped and came feet foremost to the ground. I shot it as it rose and found a lizard in its claws.

(221) Circus macrurus.—The Pale Harrier.

Blanford, No. 1233 ; *Jerdon, No.* 51.

A winter visitor both to the low country and the hills from November to February. I have shot it in paddy fields round Trevandrum and in grass land on the High Range at 6,000 feet.

(222) Circus cineraceus.—Montagu's Harrier.

Blanford, No. 1234 ; *Jerdon, No.* 52.

Like the last, Montagu's Harrier may be found in winter both in the hills and on the plains. It arrives however about a month later.

(223) Circus melanoleucus.—The Pied Harrier.

Blanford, No. 1236 ; *Jerdon, No.* 53.

This is an occasional visitor and not so common as the last two. It frequents the low country as well as the hills. It stays later than they do as I have seen specimens in the beginning of April.

(224) Circus æruginosus.—The Marsh Harrier.

Blanford, No. 1237 ; *Jerdon, No.* 54.

This is the commonest of the Harriers, and like the rest a winter visitor. It frequents paddy fields in the low country from October to April, but does not ascend the hills.

(225) Buteo desertorum.—The Common Buzzard.

Blanford, No. 1241 ; *Jerdon, No.* 47.

I have often seen these birds on the grass land at Ponmudi, but the Museum possesses no specimen. Mr. F. W. Bourdillon says of it:—"A winter visitor, seems to be not uncommon during December, January and February, preferring high open country, where two or three may be seen steadily quartering the ground and occasionally pouncing on some mouse or lizard. I have seen them perch both on trees and on stones, and once saw one as low as 2,000 feet elevation, where it was beating backwards and forwards over a field of young coffee."

(226) Astur badius.—The Shikar.

Blanford, No. 1244 ; *Jerdon, No.* 23.

A resident, and very common in the low country and at the foot of the hills. It occasionally ascends them, but only where there is open land. "Breeds profusely in the plains from March to June, in this respect differing from other birds of prey which have finished breeding long ere this. The nest is always placed on a tree and contains from three to four eggs, pale bluish-white without any markings and of that peculiar roughish texture seen in the eggs of goshawks and sparrow-hawks. The average of four eggs is 1·6 × 1·24.—*T. F. B.*"

(227) LOPHOSPIZIAS TRIVIRGATUS.—The Crested Goshawk.
Blanford, No. 1246 ; *Jerdon, No.* 22.

This fine hawk, though resident, is by no means common. It keeps to the forest-clad hills and is seldom seen away from them. "It breeds in our forests at elevations of 1,500 to 2,000 feet above sea-level. I have twice taken their nests. On the first occasion I observed a bird fly off a nest about 30 feet from the ground, and as I had no cooly with me and the tree was not a difficult one I went up to the nest myself. The nest was a frame-work of sticks, larger at the bottom and gradually decreasing in size, with a lining of leaves, the last additions, which were those of the Iron-wood tree (*Mesua ferrea*), being quite fresh. It measured 18 inches in diameter and contained two slightly set eggs. These were of a rough texture, and when held up to the light seemed to have a slightly greenish tinge. The ground colour was white and they had a few very slight brown marks, but as a rule seemed like magnified specimens of *Butastur teesa*. This was in March. The second nest, which I found in April, contained a couple of young birds, and it is to be noted that the colour of their eyes was a fine dark brown, contrasting with those of adult birds, which are bright yellow.— *T. F. B.*"

(228) ACCIPITER NISUS.—The Sparrow-Hawk.
Blanford, No. 1247; *Jerdon, No.* 24.

I have not come across this bird myself, nor is there a specimen in the Museum. It is a rare winter visitor, as Mr. F. W. Bourdillon secured only one on the hills, which was a nearly adult female.

(229) PERNIS CRISTATUS.—The Crested Honey-Buzzard.
Blanford, No. 1249 ; *Jerdon, No.* 57.

This I should say is also a rare winter visitor. I secured a single specimen at Pirmerd near the Peryaar dam in January 1901.

(230) FALCO PEREGRINUS.—The Peregrine Falcon.
Blanford, No. 1254 ; *Jerdon, No.* 8.

My collectors secured a single specimen on the backwaters of North Travancore in December 1903, and saw a second also near the backwater at Quilon.

(231) Falco peregrinator.—The Sháhin Falcon.

Blanford, No. 1255; *Jerdon, No.* 9.

A single specimen of this fine falcon was shot by Mr. Walch in Trevandrum in November 1893, and sent to the Museum.

(232) Falco severus.—The Indian Hobby.

Blanford, No. 1261; *Jerdon, No.* 14.

The Hobby may be seen on the hills and occasionally in the low country in the cold season. Mr. F. W. Bourdillon says of it:—"A winter visitor, though (without having taken a nest) I have reason to think it breeds here." Mr. T. F. Bourdillon writes:—"Though I have never taken the eggs, I have little doubt that the Indian Hobby breeds with us. A pair of birds one year frequented a piece of forest on a very steep slope, and though I was unable to find the nest at the time, I afterwards found what I believe was their nest on a tree overhanging a precipice. The breeding season, as with nearly all birds of prey, is early, and probably extends from January to March."

(233) Tinnunculus alaudarius.—The Kestrel.

Blanford, No. 1265 ; *Jerdon, No.* 17.

A common winter visitor to the hills. "On one occasion I noticed a pair of old birds feeding their young in a nest perched on the ledge of an inaccessible rock at the elevation of 2,800 feet during the month of April, and since then I have satisfied myself that the birds do breed with us by the energy with which I have seen them driving away other birds of prey from the neighbourhood of their breeding places.—*T. F. B.*"

(*To be continued.*)

NOTES ON SOME OF THE PLANTS INTRODUCED INTO THE VICTORIA GARDENS, BOMBAY, DURING THE PAST 8 YEARS.

By Cavasji D. Mahaluxmivala.

Part IV.

(Read before the Natural History Society of Bombay on 16th June 1904.)

51. Gerbera Jamesoni,* *Bolus* (Compositæ).—The Barberton or Transvaal Daisy. It is a dwarf herbaceous perennial native of the temperate or mountainous regions of South Africa. The leaves are large, radical, leathery, dark green, arranged in a rosette, runcinately pinnatifid and toothed. The flower heads are solitary, on a long naked and partially nodding stalk, resembling annual chrysanthemums in size and shape. The ray florets are dull yellow beneath and bright orange or flame coloured above. It has been flowering irregularly throughout the year, being found in flower in January, March, July, &c. The plant was purchased in January 1898 from the Agri-Horticultural Society of India, Calcutta, and thrives well in the conservatory, but not so well in the open border, as it cannot bear direct exposure to the sun, especially in the hot weather. It can be propagated from seeds and by side-shoots, but is found difficult to propagate as it does not seed or very scantily, and the side shoots are very few and produced at very long intervals.

52. Wormia Burbidgei † *Hook. f.* (Dilleniaceæ).—It is said to be a tree of Borneo, but the plant I have lately got appears to be a shrub, is not more than a foot high and has already flowered. The leaves are large, elliptic, the base of the leaves running down to the winged petiole which clasps the stem at the base. The flowers are pale golden yellow, about 3 inches in diameter, with white stamens in many series. It is said to be propagated from seeds and with some difficulty from cuttings, but the plant in the gardens is yet too small for propagation. It was received in exchange from the Superintendent, Royal Botanic Gardens, Calcutta, in February 1903, and has produced a few flowers in June and July.

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* The genus is named in honour of Mr. Gerber, a German naturalist, and the specific name after Mr. R. Jameson who is said to have discovered the variety in Transvaal, near Barberton, in 1887.

† The genus is named after Olaus Wormius, a famous Danish philosopher and naturalist, and the specific name after Burbidge.

53. TINNEA ÆTHIOPICA,* *Kotschy* (LABIATÆ).—It is a hoary shrub of tropical Africa, growing to a height of about 6 feet. The leaves are small, opposite, petioled, ovate, narrowed at the base, and emarginate and mucronate. The flowers are copiously produced, axillary, fragrant, the scent being almost like that of violets; calyx large, two-lipped, covering the tube of the corolla; corolla also two-lipped, and of a dark maroon-purple colour. The fruit consists of four separate winged nutlets closed in the enlarged and inflated calyx. It can be easily propagated from seeds or by cuttings, by which latter method the plant has been easily propagated here. It was purchased from the Government Agri-Horticultural Gardens, Lucknow, in January 1900, and seems to do well here, flowering occasionally in the rains and throughout the cold season.

54. ACACIA HOUSTONI † (LEGUMINOSÆ).—It is an ornamental shrub, native of Mexico, growing to a height of about 7 or 8 feet. The leaves are handsome, bipinnate with the small narrow leaflets set like the teeth of a comb. The crimson flowers of the bottle-brush form are produced in globose heads during the rains and in the cold weather; the calyx and corolla are hairy, light brown, but the petals are perfectly white inside, forming a conspicuous background to the numerous, long, rosy-purple stamens. The plant does not seed here and is propagated by gooties only. It was purchased from the Agri-Horticultural Society of India, Calcutta, in January 1898, and seems to thrive well in Bombay.

55. CALLIANDRA HÆMATOCEPHALA,‡ *Hassk.* (LEGUMINOSÆ).—The habitat of this shrub is uncertain, but it is probably a native of tropical America. The leaves are bipinnate with seven to ten pairs of small opposite pinnules. It bears in the cold season numerous heads of lovely blood-red bottle-brush like flowers composed chiefly of the numerous, radiating, blood-red stamens. It is said to seed sparingly, and has not seeded here yet, but has been propagated by cuttings and gooties. The plant was purchased from a local nursery in Bombay in March 1901, and seems to thrive well. This plant bears a great resemblance in habit, &c., to *Acacia Houstoni* described above.

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* The genus is named after Mdlle. Tinné, a Nile voyager, and the specific name means African.

† The generic name is derived from *acus*, a needle, on account of many of the species being furnished with spines, though the plant described here is unarmed, and the specific name after Houston.

‡ The generic name is derived from *kallos*, beauty, and *andros*, a stamen, referring to the elegant long silky stamens, and the specific name means "bloody-headed" in reference to the colour of the stamens, which are the most conspicuous part of the flower.

56. Acacia auriculiformis * (Leguminosæ).—A rapid growing tree, native of Australia. It is very ornamental with its shiny scimitar-shaped leaves 6″ × 1″, and sweet scented small yellow flowers in terminal spikes. It can be readily propagated from seeds. Plants were raised from seeds presented by the Superintendent, Agri-Horticultural Society, Madras, in May 1898, and seem to do well here, flowering during the rainy season.

57. Brunfelsia latifolia,† *Benth.* (Scrophulariaceæ).—It is an elegant perennial shrub about 3 feet high, native of Brazil, much resembling in habit but not so free-flowering as *B. Americana*, which is a taller shrub, producing throughout the year yellowish flowers afterwards turning white. The leaves are alternate, about 3″ × 1″, of a refreshing green colour. The flowers produced throughout the rains and the cold weather are terminal, salver shaped, about 1½″ in diameter, fragrant, purple coloured at first with a distinct white eye, turning lilac later on. It has been propagated by layers or gooties. The plant was purchased from the Government Agri-Horticultural Gardens, Lucknow, in January 1900, and thrives well here, flowering twice a year, in the rains and again in the cold weather.

58. Solidago canadensis,‡ *L.* (Compositæ).—Canadian Golden Rod. It is a North American hardy perennial herb, commonly grown in English shrubberies and reputed to possess vulnerary qualities. The leaves are alternate, lanceolate, acuminate, sharply toothed, downy beneath and rough above. The flower heads are very small, one-sided, in numerous crowded terminal panicles of short, bright yellow florets. It is easily propagated by division, as it spreads very rapidly where planted, and is required to be kept in check if planted in a mixed border. The plant was purchased from the Agri-Horticultural Society of India, Calcutta, in February 1898, and thrives well here, flowering almost throughout the year. It is a straggling plant, growing rapidly in the rainy season with tall branches. The growth, however, gradually becomes dwarfer during the cold season, and it takes a short rest in the hot weather before starting again into growth.

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* The generic name is derived from *acus*, a needle, on account of many of the species being furnished with spines, though the plant described here is unarmed, and the specific name means "ear-lap-shaped" probably from the form of the leaves.

† The genus is named after Otto Brunfels, a physician of Mentz, and the specific name means "broad leaved."

‡ The generic name is derived from Latin *Solido*, to join or make whole, alluding to its reputed vulnerary qualities, and the specific name means "Canadian," from its native habitat.

59. Panax Balfourii* (Araliaceæ).—It is an elegant though rather stiff looking plant of dwarf growth, native of New Caledonia, ornamental on account of its large orbicular, variegated leaves, scalloped and serrated at the edge, light green, blotched and margined with creamy white. It has been propagated by gooties and cuttings. The plant was received in exchange from the Superintendent, State Gardens, Baroda, in November 1901, and seems to do well here.

60. Kopsia fruticosa†, *A. Dc.*—(Syn. Cerbera fruticosa), (Apocynaceæ).—It is a large spreading evergreen shrub, native of India and Malay Peninsula. The leaves are opposite, 4″×1½″, elliptic, narrowed into a very short petiole, shining green above, paler beneath and thinly coriaceous. The flowers are handsome, salver-shaped, light pink at first with a distinct red eye, turning white later on, resembling very much those of *Vinca rosea*. It has been propagated by layers or gooties. The plant was purchased from the Agri-Horticultural Society of India, Calcutta, in January 1898, and seems to do well here.

61. Nandina domestica,‡ *Thb.* (Berberideæ).—Sacred Bamboo of China. A very handsome, compact, many stemmed, erect, evergreen shrub of China and Japan, growing to a height of about 7 feet. The foliage, which is very ornamental and graceful, is decompound with sheathing petioles at the base, and each of the several branches consisting of 6 pairs of leaves which are often trifoliate. It is very useful for decoration, and makes a good substitute for ferns when the latter are not available. The flowers are said to be white with yellow anthers, of no great beauty, borne on upright branching spikes, and its bright scarlet berries, contrasting with the dark shining leaves, are said to add much to the beauty of the plant at fruiting time; but the plant has not yet flowered or fruited here. It can be propagated by division or by cuttings. The plant was purchased from the Government Agri-Horticultural Gardens, Lucknow, in January 1900, the one obtained in August 1899 from the Calcutta Agri-Horticultural Society of India having been lost, and is doing well here. It forms a good specimen on a lawn and is suitable for vases also.

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* The generic name is derived from an old Greek name used by Theophrastus and akin to *panakes*, a panacea or remedy for all complaints, applied to the genus in reference to the stimulant drug, Ginseng, derived from one or two species of it; and the specific name is after Balfour.

† The genus is named after Jan Kops, Professor in Utrecht, and the specific name means "shrubby."

‡ The name is derived from *Nandin*, the vernacular name of the shrub in Japan, and the specific name means "domestic."

62. Habenaria Susannæ,[*] *R. Br.* (Orchideæ).—A very handsome, tall, herbaceous, terrestrial orchid, native of India and China. The leaves are large, ovate-oblong, 9″ × 4″ with sheathing bases, imbricating (overlapping) up to the flowers. Stems about 4 feet high. The flowers are large in 3 to 5 flowered racemes, white, fragrant, with a long spur and the side lobes of the lip very broad and pectinate (comb-like). The plant was received in exchange from the garden of the College of Science, Poona, through Professor Page, in July 1899, and some more afterwards from the Superintendent, Empress Gardens, Poona, in August 1901, and from Lanouli through Mr. Ghaswalla. The tubers start into growth at the beginning of the monsoons, and after flowering at the end of the rains, they gradually dry down and are at rest in the cold and hot seasons.

63. Ficus Parcelli,[†] *Veitch* (Urticaceæ).—It is a large variegated shrub of Polynesia. It is ornamental simply on account of its leaves which are large, 8″ × 5″, hispid, oblique, oblong, acuminate, serrated, bright green and irregularly blotched with ivory white, which give the plant a striking appearance. It can be propagated by cuttings. The plant was presented by the Superintendent, State Gardens, Baroda, in December 1896, and thrives well here. This plant seems to be grown in England as a decorative greenhouse shrub, but in South Africa it is reported to be growing into a noble tree about 25 feet high. The plants planted in the Victoria Gardens have not yet grown more than about 6 feet high.

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[*] The generic name is derived from *habena*, a thong or strap, on account of the long strap-shaped spur, and the specific name after Susanna, probably from its Heb. meaning of lily.

[†] The generic name is derived from the old Latin name akin to the Greek *sfukon* or *sukon*, a fig, and the specific name after Parcell.

TWO NOTORIOUS INSECT PESTS.

By R. S. Hole, I.F.S., F.C.H., F.L.S., F.E.S.,
Officiating Deputy Conservator of Forests,

With Plates A to E.

(Read before the Bombay Natural History Society on 16th June 1904.)

1. So far as our knowledge at present extends, the two most dangerous insect enemies of the famous teak tree, *Tectona grandis,* in India and Burma are the two moths known, respectively, as *Pyrausta machœralis* (syn. *Paliga damastesalis)* and *Hyblœa puera.*

2. My attention was first attracted to the great damage wrought by these insects in the teak forests of the Central Provinces in 1898, and since then I have endeavoured to collect as much information as possible about them and their way of life. The following notes have been compiled from observations made in the Damoh and Jubbulpore districts of the Central Provinces during the period 1898—1902. Official work and the necessity of being constantly in camp have made it impossible for me either to devote as much time as I should have liked to these insects and their attacks, or to breed and keep under continual observation a sufficient number of specimens of each species, which will, I trust, be accepted as to some extent explaining the incompleteness of the notes and the imperfections of the illustrations which accompany them. I venture, however, to put them forward as they are, seeing that my recent transfer from the teak region will make it impossible for me to correct or supplement them for some time to come.

3. Both these insects have a wide distribution, being found wherever teak forests occur in India and Burma. The climatic conditions under which the insects live in different localities, therefore, vary considerably, and the present notes, referring as they do to a very small area, require comparison with the results of observations made in other localities, before we can hope to compile a complete life-history of these pests which will apply to all teak forests in India and Burma. This note will, I hope, in a small way, aid the preparation of an account of these pests which, when complete, should make it possible to adopt some plan of action by means of which the teak may be, to some extent at all events, protected from them.

DESCRIPTION OF THE INSECT.

A. *Pyrausta machœralis*—

4. *Moth.*—The type is described in Hampson's Moths, Vol. IV., p. 433. It is there noted that the hind wing has a crenulate postmedial line, bent outwards between veins 5 and 3, along which it is retracted. In the large number of specimens examined by me I have been unable to trace this line. Fig. I. represents the type as commonly found in these forests.

5. *Egg.*—The eggs are small, round, greenish, gelatinous bodies which are usually laid singly on the backs of the young teak leaves close to a rib or small vein.

6. *Larva.*—The mature larva is elongate, its length (in decimals of an inch) varying from 0·83 to 0·98 and its mid-diameter from 0·08 to 0·11. Segments are 14 in number including the head. Segments 2, 3 and 4 each carry a pair of true legs, and segments 7, 8, 9, 10 and 14 each carry a pair of prolegs. Colour of mature larva is sap-green above and pale below with two yellow dorsal lines, these lines being sometimes tinted with reddish-purple. Between these lines on each segment, from the 5th to the 12th inclusive, are four yellow spots bearing dark-purple marks. On the 3rd and 4th segments only two such marks are conspicuous, while the 2nd has none, it being spotted with minute black specks. On each side, below the yellow dorsal lines, are light-coloured lateral marks tipped with purple, these being more or less indistinct, except on segments 3 and 4, where they are conspicuous. The dorsal marks are generally crescent-shaped, the lateral marks being on a line with the first pair of dorsal marks on each segment. Head is yellow, and a few erect hairs are scattered over each segment. Fig. II. shows the mature larva, seen from above. On emerging from the egg, the larva measures $\frac{1}{12}$th of an inch in length and is active from the first. Its colour is then a dirty-white, which gradually changes to pale-green. The purple markings are usually not distinct until the larva is 5 or 6 days old, its colour then being bright sap-green above and yellow below. The construction of the cocoon usually occupies one day, and pupation takes place inside the cocoon, two days after the larva has stopped feeding. During the hibernating stage, however, the larva remains in the cocoon for 22 weeks, after which period pupation takes place as usual. Just before each change of skin the larva becomes torpid and contracts in

Fig III (a) $\frac{1}{1}$

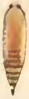


Fig. I. $\frac{1}{1}$

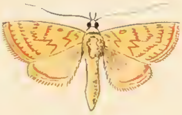


Fig. II. $\frac{1}{1}$

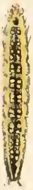
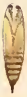


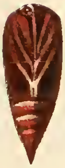
Fig III (b) $\frac{1}{1}$

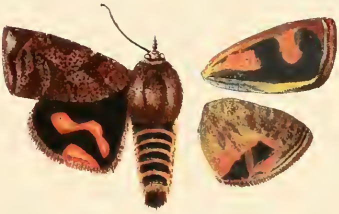


Pyrausta machœralis.

Fig I. imago. Fig. II. larva. Fig III(a) pupa (back) Fig III (b) pupa (front)

Fig. VII. $\frac{1}{1}$





(a) (b)

Fig. IV. $\frac{1}{1}$

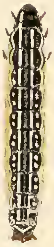


Fig. V. $\frac{1}{1}$

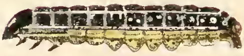


Fig. VI. $\frac{1}{1}$

NOTORIOUS INSECT PESTS.

Hyblaea puera.

Fig. IV. imago. Fig. IV (a) showing upperside & Fig. IV (b) the underside of the wings.

Fig. V. larva (dorsal view)

Fig. VI. larva (side view)

Fig. VII. pupa (front)

Mintern Bros. Chromo. London

size. At the same time its colour fades and becomes pale. Just before pupation the colour of the larva is a pale-yellow, the dark-purple markings being then very distinct and characteristic.

7. *Pupa.*—Slender. Colour yellowish-brown, dark on back, pale to white in front, with a few scattered bristles. On the top of the head, between the eyes, are two small dark bristles. At the point of the tail there is a minute hook, with two outwardly pointed branches. Figs. III. (*a*), III. (*b*) represent, respectively, the back and front view of the pupa. To determine the dimensions of the pupa, 51 normally developed specimens were measured, which showed that the length varied from 0·52 to 0·43 of an inch and the mid-diameter from 0·09 to 0·13.

B. *Hyblœa puera*—

8. *Moth.*—The type is described in Hampson's Moths, Vol. II., p. 371, and is represented in Fig. IV. Fig. IV (*a*) shows the upper side and Fig. IV (*b*) the under side of the wings. The colouring and markings, however, vary considerably from those of the type in different specimens. From a number of moths collected by me in 1901, I selected eleven which showed the greatest variations, and sent them to Mr. De Nicéville for opinion, pointing out that in minor details the colouring of some specimens approached that of *Hyblœa constellata.* Mr. De Nicéville identified them all as *Hyblœa puera,* remarking that "the species is obviously a very variable one." The ground colour of the thorax and forewing above is often ashy-grey and the forewing has frequently more or less extensive greenish, or yellowish-white, diffused patches on the upper side, which are triangular in shape when the wings are closed. On the under side the costa and apex of the forewing, the whole of the hindwing, as well as the abdomen below and at the sides are sometimes suffused with crimson, whereas in the type, the underside of the abdomen is pale-yellow shaded with brown.

9. *Egg.*—The eggs are striate, yellowish or greenish in colour, oblong, with long diameter 0·05 of an inch. They are somewhat transparent, and the dark head of the young larva can be distinctly seen inside the egg, shortly before hatching. After hatching, the empty egg-shells are colourless.

10. They are laid singly on the back of the young leaves, generally in an angle between two veins, or where the lateral veins join the midrib. The youngest leaves are usually selected for egg-laying, so

that the young larva may have plenty of soft leaf tissue near at hand. Fig. VIII. shows an egg on the back of a leaflet of *Millingtonia hortensis.*

11. *Larva.*—On emerging from the egg, the larva is pale-reddish or greenish-yellow in colour with a black head and dorsal black mark on the first somite. It is then $\frac{1}{12}$th of an inch long and is active from the first. The colour of the dorsal surface gradually darkens and becomes greyish-green, the under surface being paler, the head and dorsal band on the first somite being jet black.

12. When about a week old, a change of skin takes place, after which the appearance of the larva entirely changes, the colouring now being practically that of the mature larva, which then remains but little changed until the end of the larval existence. The general colour is now dark purple-grey to black above and bright yellow to greyish-green below. The larva taken as the type, in Hampson's Moths, is described as follows : " With a few short hairs ; dark purple-grey above, olive-green below, with dorsal and lateral white lines, a subdorsal series of minute white dots and rings, a series of black dots on lateral line ; head and first somite black." Fig. V. shows the dorsal view and Fig. VI. the side view of the larva which appears to have been taken as the type.

13. A reference to the illustration (Fig. V.) will show that a pale, indistinct line runs along the centre of the back, which I will designate (*a*) and that there are two clear white dorsal lines, one on each side of the central line (*a*) which we will call (*cc*). Below these dorsal lines there is a clear white lateral line, running along each side of the larva, just above the junction of the upper grey and lower yellow colour as shown in Fig. VI. These lateral lines may be called (*dd*). The spaces between the central line (*a*) and dorsal lines (*cc*), which I will call (*bb*), are practically the same colour as that portion of the sides between the lines (*cc*) and (*dd*). This upper part of the sides I have called (*ee*).

As might have been expected in the case of an insect the imago of which is so variable, the colour of the larva also exhibits great variety. These variations are most marked in the case of the central dorsal line (*a*) and the adjacent spaces (*bb*). In some cases, line (*a*) instead of being pale-grey or smoky is orange or flesh-coloured, the spaces (*bb*) being well marked and as dark as the upper part of the sides (*ee*). The flesh-coloured or orange line, in other specimens, gets gradually wider until, finally, it occupies the whole of the space covered by the central line

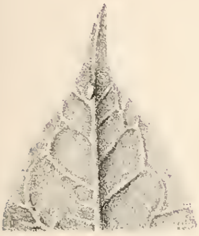


Fig. VIII. $\frac{1}{1}$

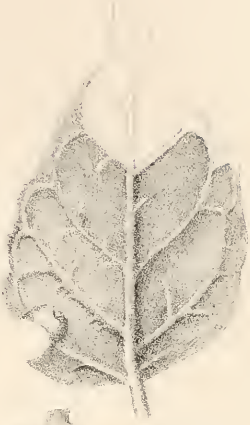


Fig. IX. $\frac{1}{1}$

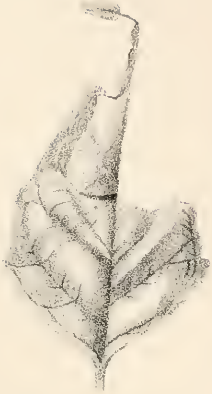


Fig. X. $\frac{1}{1}$

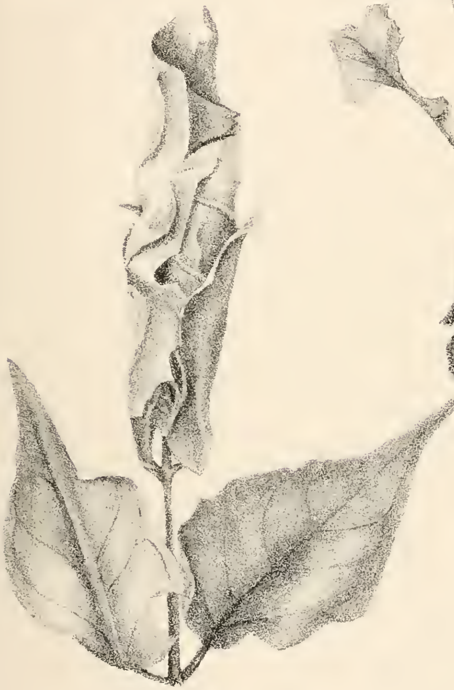


Fig. XI. $\frac{1}{1}$

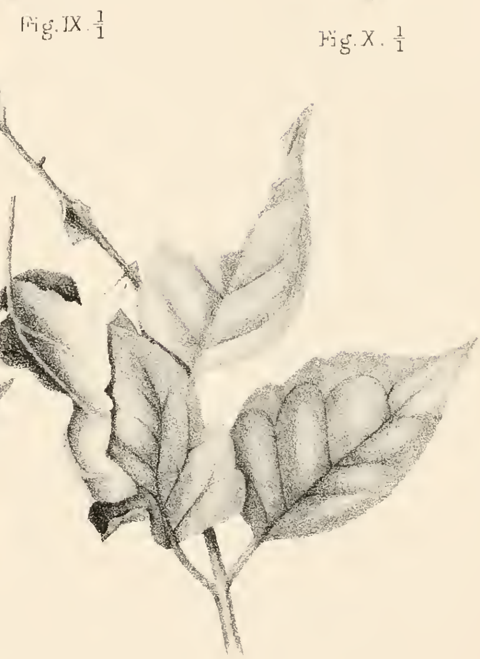


Fig. XII. $\frac{1}{1}$

NOTORIOUS INSECT PESTS

Fig. VIII. Shows an egg of Hyblaea puera *on back of a leaflet of* Millingtonia hortensis *in angle between middle and lateral vein.*

Fig. IX. Shows first sign of larval attack of Hyblaea puera *on leaflet of* Millingtonia hortensis. *The turned down flap contains a small larva.*

Figs. X & XI. Showing larval shelters of Hyblaea puera *on leaflets of* Millingtonia hortensis.

Fig. XII. Showing mode of attacking the leaves of Millingtonia hortensis *by larva of* Hyblaea puera. *Also a larval shelter in which pupation took place.*

Mintern Bros. lith. London.

(*a*) and the adjoining spaces (*bb*), the orange colour then extending over the middle of the dorsal surface as far as the white lines (*cc*) on either side. The spaces (*bb*) may be as dark as the upper part of the sides (*ee*), or they may be considerably paler, and their colour spreads transversely along the junction of two adjacent segments, thus more or less interrupting the central line (*a*). All the colours become pale shortly before pupation, and it is often difficult to determine to what extent the normal colouring has been modified by this approaching change.

14. I have by no means indicated all the variations of colour which the larva may present, but the most constant and remarkable variations certainly appear to be with respect to the presence or absence of the orange dorsal line and to the extent of the space occupied by it when it is present ; and I particularly wish to emphasize the fact that there appears to be a complete series of intermediate forms, uniting the two extremes, in which the orange or flesh-coloured line is entirely absent and in which this line occupies the whole of dorsal surface between the white lines (*cc*), respectively.

15. The larva is shy and seldom exposes its whole body to view voluntarily. It usually constructs for itself, among the leaves on which it feeds, a shelter in which it lies during the day and in the neighbourhood of which it feeds at night. Consequently it is somewhat difficult to measure it ; for, if measured when at rest, crouching in its shelter, the measurements are too small, while it moves so quickly if disturbed that it is difficult to measure it when extended to its true length. Measurements recorded by me gave the length and mid-diameter in inches of the mature larva as 1·26 and 0·22, respectively. It tapers to both ends.

16. *Pupa.*—Stout, colour bright brown to very dark purplish-brown or black, with a few scattered bristles. Tail short, obtuse, furnished at the extremity with a hook, like a minute grapnel with several flukes or claws. Length and mid-diameter in inches 0·74 and 0·21, respectively. Fig. VII. represents the pupa.

17. The above descriptions have been given in considerable detail for the following reasons :—

(1) The descriptions of the eggs, larvæ and pupæ at present on record are meagre and of little help in the identification of the insects, while the work of preparing a complete account of the pests will clearly be greatly aided if observers are able to identify the insects in any stage of their existence.

(2) In the case of *Hyblæa puera* the moth is very variable and the colouring and markings often resemble those of *Hyblæa constellata*. The latter moth has recently been reported as attacking teak in Burma, in company with *Hyblæa puera*, and it is therefore possible that these insects may be confused. In recording observations, with the object of completing their several life-histories, it is clearly most important to make sure of the identification in each case, and it should be remembered that *Hyblæa constellata* is separated from *Hyblæa puera* by two main characters which appear to be constant and are as follows :—

(*a*) *H. constellata* has the outer margin of the forewing excised below the apex and excurved at the centre, whereas in *H. puera* the margin is evenly curved and not excised.

(*b*) *H. constellata* has in the anal angle, on the underside of the hindwing, a single black spot, whereas there are two such spots in *H. puera*.

(3) Mr. Stebbing* has recently separated a variety of *H. puera* which he has provisionally named *H. nigra*, the principal character relied on to distinguish the variety being the dark colour of the dorsal surface of the larva and the absence of any flesh-coloured dorsal line. In the larval description given above I have shown that there exists a complete series of intermediate forms, uniting the dark-coloured larva with no flesh-coloured stripe with the larva in which this stripe covers the whole of the dorsal surface between the dorsal white lines. With such a variable insect I cannot but think that it will ultimately prove impossible to regard *H. nigra* as a well-marked or important variety, and that, therefore, it is inadvisable to attempt to classify it separately, at all events in the present state of our knowledge. So far as is known at present also, the life-history, and relation of the variety to the forest, differ in no particular from those of the type.

LIFE HISTORY.

I. Larval Food-plant.

A. *Pyrausta machœralis*—

18. Personally, I have never found the larvæ feeding on any plant other than the teak tree. It is remarkable, however, that, in the case of the individuals bred by me, the moths appeared, at the end of the hibernating stage in the month of April, although in the dry forests to

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* *Departmental Notes on Insects that affect Forestry*, by E. P. Stebbing, F.L.S., F.E.S., No. 2 Calcutta, 1903, pp. 294—297.

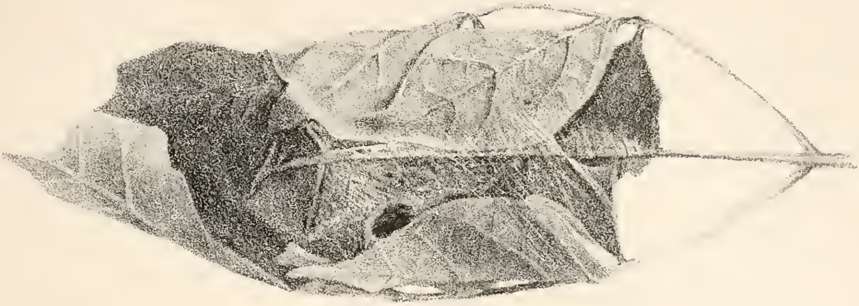


Fig. XIII.

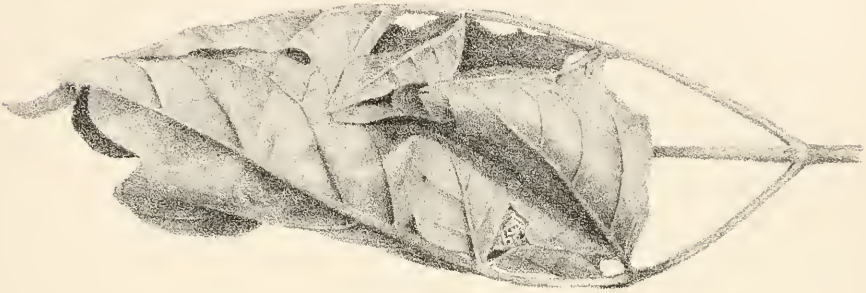


Fig. XIV.

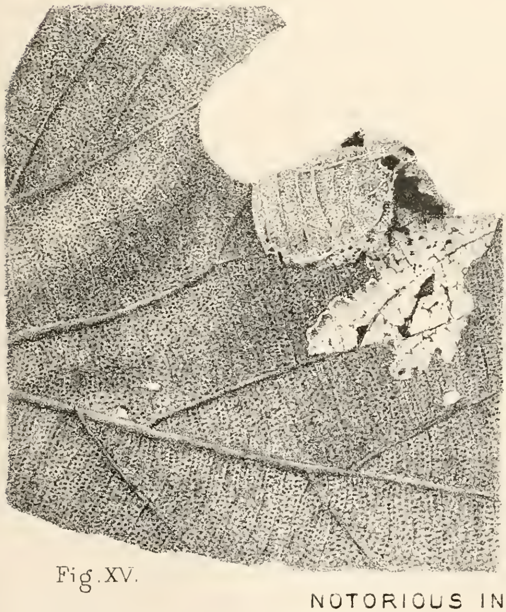


Fig. XV.

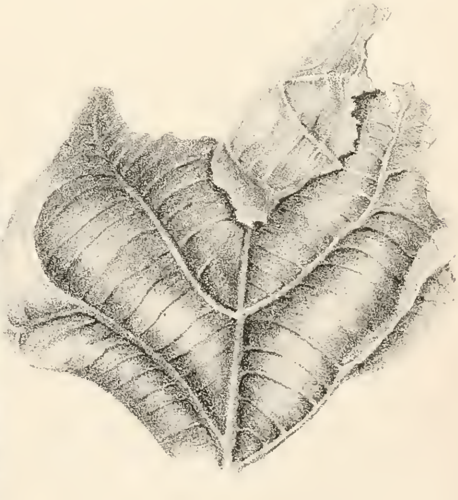


Fig. XVI. $\frac{1}{1}$

NOTORIOUS INSECT PESTS.

Fig. XIII. Showing front view of a shelter made by a large larva of Hyblaea puera *on leaf of* Millingtonia hortensis.

Fig. XIV. Shows back view of the same larval shelter.

Fig. XV. Showing shelter made by a young larva of Hyblaea puera *on a teak leaf and the portion of the leaf eaten by it.*

Fig. XVI. Showing larval shelter made by Hyblaea puera *on a teak leaf in which pupation occurred.*

which these notes refer the teak trees do not come into leaf until June-July. This led me to think that the larvæ fed on some other plant during April-May, but I was unable to prove this to be the case.

B. *Hyblæa puera*—

19. Hampson gives *Bignoniaceæ* as the food-plant. During the rains of 1901 in Jubbulpore the insect was not very numerous, and, although I searched carefully, I could only find the larvæ on the leaves of *Millingtonia hortensis*, with the exception of two isolated individuals seen on teak on August 15th.

20. I made several attempts to make larvæ bred on *Millingtonia* leaves, eat teak leaves, but met with very little success. The larvæ, if able to escape, at once left the teak leaves to search for other food; if unable to escape and kept from other food they usually die. If almost mature, the larvæ, in a few cases, pupated, but very little, if any, of the teak leaf was ever eaten. A fairly full-grown larva taken from a *Millingtonia* tree on September 12th and placed on a teak leaf, ate a little of the leaf and constructed a shelter by turning down the end of the leaf in which it lived until September 15th, when it pupated inside the shelter. Fig. XVI shows the shelter and the small portion of leaf which was eaten.

21. Another young larva taken from a *Millingtonia* tree on September 19th and then fed on teak leaves lived for 11 days, died on September 30th, just after a change of skin. This larva constructed a shelter by cutting and turning over a flap on the edge of the leaf. Fig. XV shows this shelter with the portion of leaf eaten by the larva close to it. When fed on *Millingtonia* leaves, I found that several larvæ attained their full development and pupated in 10 days, whereas this larva, fed on teak, although more than 11 days old, was then scarcely half grown and, as the photograph shows, it had then only just acquired the power of biting through the fine veins of the leaf. In this case the larvæ preferred *Millingtonia* leaves to those of teak, and probably other plants belonging to *Bignoniaceæ* are preferred to teak when they are available. It is clear that the larvæ did not readily adapt themselves to the teak diet and that many perished through their inability to do so. It appears, therefore, that the development of the larvæ can be considerably checked by destroying the supply of their favourite food, and this is, at the same time, an indication of the enormous numbers in which the larvæ must occur in years when they are able to

completely defoliate trees, so dissimilar as are teak and *Albizzia lebbeke*, which was the case in Jubbulpore in July 1900.

II. Habits of the Larva.

A. *P. machœralis*—

22. The larvæ, if disturbed or alarmed, at once let themselves down by threads from the leaves in which they are feeding, and thus either reach the ground, or, after hanging suspended in the air for some time, climb back again on to the leaves.

23. The method of feeding is very characteristic. Only the soft green parenchyma of the leaves is destroyed, and the veins and vascular tissue are left untouched. The leaves are thus skeletonised, and fine specimens of such leaves may be obtained when larval attacks are severe, which are sometimes used for ornamental purposes. The young larvæ at first only destroy the epidermis of the leaf, their mandibles not being fully developed, and the leaf tissue is thus at first not pierced. The attacked leaves become brown in colour, and before they fall give the forests a most remarkable appearance, which is very striking during the monsoon, when the rest of the country side is green. From a distance such forests look as if they had been damaged by frost or scorched by fire. Fig. XVIII shows a photograph of a piece of teak leaf attacked by this insect. Here and there, it will be noticed, are a few small holes where the veins of the leaf have been destroyed. These are caused by the habit which this larva has of gnawing small boltholes in the leaf-tissue, near which it lies when feeding and by means of which the larva can at any time gain ready access to the front or back of the leaf at need.

24. When the larvæ are feeding on the leaves, they usually construct a thin weft of silk threads which is attached to the surface of the leaf and under shelter of which the larvæ lie. This web does not conceal the larvæ from view.

B. *H. puĕra*—

25. The larvæ, when disturbed, let themselves down by threads from the leaves on which they are feeding, just as is the case with the preceding species. The larvæ acquire this power almost immediately after emergence from the egg.

26. When irritated the larva emits a dark-green fluid which it ejects from its mouth to a considerable distance.

27. As already noticed above, the larva is shy and seldom exposes its whole body to view, always constructing hiding places for itself on

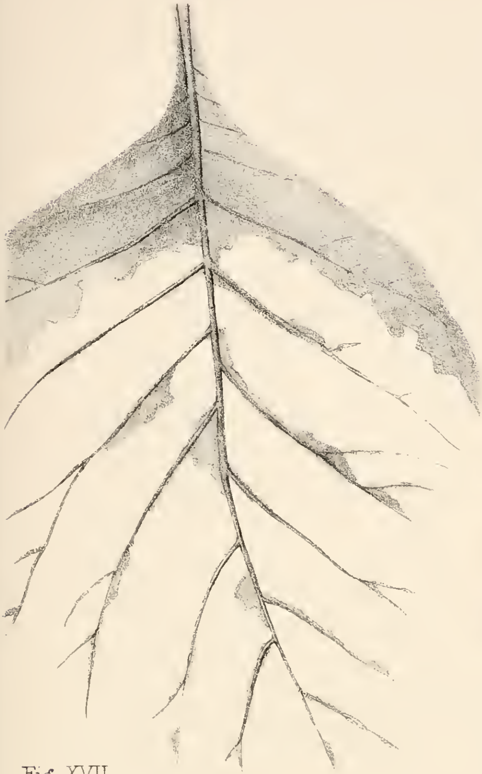
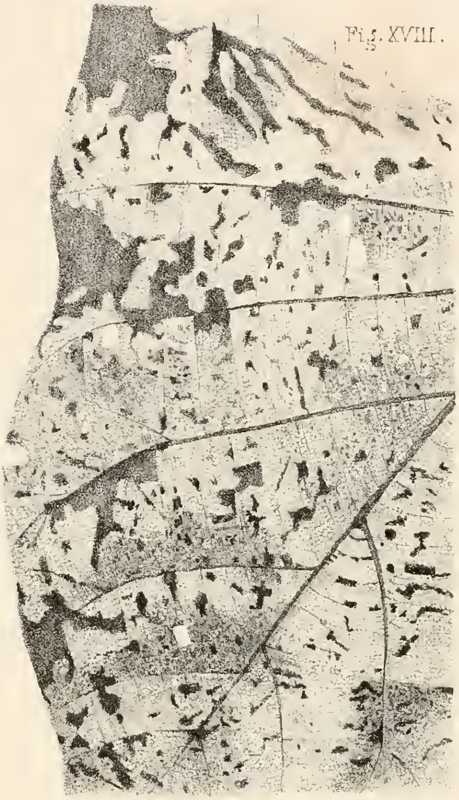


Fig. XVII.

Fig. XVIII.



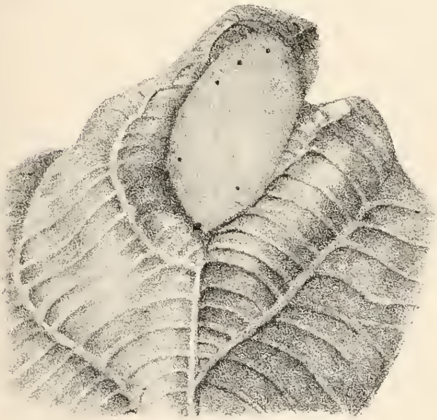


Fig. XIX. $\frac{1}{1}$

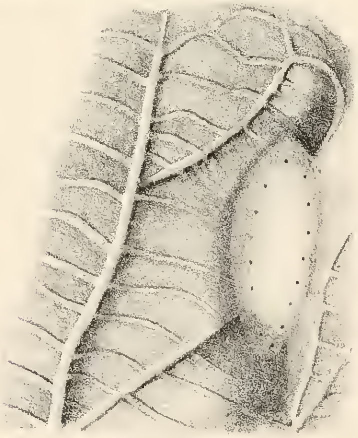


Fig. XX. $\frac{1}{1}$

NOTORIOUS INSECT PESTS.

Fig. XVII. Teak leaf showing characteristic method of defoliation by the larvæ of Hyblaea puera, *Cram.*

Fig. XVIII. Portion of a Teak leaf showing the skeletonizing method of defoliation of the larvæ of Pyrausta machœralis, *Wlk.*

Figs. XIX & XX. Showing cocoons constructed by the larvæ of Pyrausta machœralis *in depressions on the back of green teak leaves.*

Mintern Bros. lith London.

the leaves on which it feeds. On leaving the egg, the larva at first feeds on the soft parenchyma of the young leaves, but it soon acquires the power of biting through the smaller veins and it then cuts a small flap out of the edge of the leaf which it pulls over and fastens to the upper leaf surface, thus forming a small shelter inside which it lies, under the folded or curled leaf edge. Fig. IX shows the first shelter, made by a larva shortly after hatching, in the edge of a young *Millingtonia* leaflet. As the larva grows, the shelter has to be made larger to accommodate it. Fig. X shows the shelter of a larger larva, also on a *Millingtonia* leaflet. A single leaflet eventually becomes too small to hold the larva, and Fig. XI shows a case in which the terminal leaflet has been partially eaten and has then been rolled over and its lower end enclosed in the pair of leaflets immediately below it, thus forming the shelter for the larva. Figs. XIII and XIV show the front and back view, respectively, of a shelter constructed on a still larger scale on a *Millingtonia* leaf.

28. I have unfortunately been unable to secure so complete a series of drawings, to show the method of constructing the shelters on teak leaves, but they appear to be usually made by rolling over the edge or ends of the leaves. Figs. XV and XVI show the shelter of a young and mature larva respectively on a teak leaf.

29. The method of attack followed by the larva is the same in the case of both *Millingtonia* and teak leaves. The whole of the green leaf tissue is destroyed, only the largest ribs being left, with small portions of uneaten green tissue adhering to them here and there. Fig. XII shows a larval shelter and the method of attacking *Millingtonia* leaves, and Fig. XVII* shows a teak leaf attacked by the larva.

30. The larva does most of its feeding at night, but even when feeding it usually keeps part of its body inside the shelter, into which it hastily retreats on being alarmed.

31. Just before a change of skin, or before pupation, the larva lies quiescent for several hours, and it then appears to be very susceptible to injury, several larvæ dying at this time, especially just before pupation.

III. MODE OF PUPATION.

A. *P. machœralis.*

32. The pupæ of this moth may be found in a variety of places, such as on the green leaves on the trees, on the dead leaves on the

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* Reproduced from '*Departmental Notes on Insects that affect Forestry*' by E. P. Stebbing, F.L.S., F.E.S., by kind permission of the author.

ground, in crevices under the bark of the tree trunks, or in the soil underneath the trees.

33. Experiments made by me showed that about 45 per cent. of the larvæ pupated on the leaves of the trees on which they were feeding, 55 per cent. leaving the foliage and pupating in any convenient crevice under the bark, in dead leaves, or in the soil. The number of larvæ pupating on the dead leaves is about twice the number of those pupating in the soil, provided there is an ample supply of dead leaves.

34. An exception to the above remarks, however, occurs after the hibernating stage, when pupation takes place usually, if not always, in the ground.

35. The leaves on which pupation takes place, whether dead or green, are, so far as I have seen, invariably teak. On the green leaves the larva usually takes up its position in a depression along the mid-rib or a lateral vein, and there forms its cocoon, drawing the sides of the leaf loosely together with the silky web. Occasionally, the cocoon is made between two leaves which overlap, so that when these leaves are pulled apart, the cocoon is destroyed. Still more rarely, the cocoon may be made in the rolled-up edge of the leaf.

36. On dead leaves, pupation usually occurs in the edge of the leaf, which has become curled or rolled up, owing to the withering of the leaf. The cocoons are also often made in a depression of the leaf surface as in the case of the green leaves.

Figs. XIX and XX show cocoons constructed in depressions on green teak leaves. In both cases the cocoon is on the back of the leaf. In the case of green leaves, suitable depressions are usually more frequent on the back than on the front of the leaves. The cocoon, within which pupation takes place, is of white silk and of a shape to fit the depression in which it is made.

37. When pupation takes place in the soil, the cocoon is made of silk and bits of earth bound together.

B. *H. puera*—

38. Pupation may take place—

(1) In the leaves of the tree, on which the larva is feeding.

(2) In the leaves of shrubs or herbs growing beneath the trees attacked by the larvæ.

(3) In dead leaves, on the ground.

(4) In the soil.

39. As a rule, the larvæ when mature, quit the leaves on which they have been feeding and pupate in the leaves of the undergrowth below, or, in the absence of suitable undergrowth, in the dead leaves lying on the ground and in the soil. Of course pupæ may be occasionally found on the leaves of the tree attacked and on dead leaves on the ground, even where there is a thick undergrowth of shrubs below the attacked trees, but such cases appear to be exceptions to the rule. When pupation takes place on the leaves of the attacked trees, the larvæ usually leave the higher branches and pupate on the leaves of the lower branches, but occasionally the larva remains in the shelter, near which it has been feeding and pupates there. Fig. XII shows a larval shelter in which pupation occurred.

40. When the leaves on which the larva feeds are close to the ground, and there is no undergrowth, an unusually large proportion of larvæ pupate on the leaves of the attacked plants, and this is still more marked when there are no dead leaves on the ground below. This accounts for the interesting case recorded by Mr. L. S. Osmaston* in which the larvæ, which had been attacking young teak transplants in a nursery, pupated in large numbers in the rolled up ends or edges of the teak leaves. The plants were only 6 inches high, there was no undergrowth of herbs, and there were no dead leaves on the ground.

41. It will then be noticed that pupation may take place on the leaves, either dead or green, of many different plants and consequently the shelter, which the larva makes to hold the cocoon in which it pupates, exhibits great variety in shape and mode of construction. In dead leaves, depressions and hollows caused by the drying of the leaves usually exist which, with a little manipulation on the part of the larva, form suitable shelters, while on green leaves such cavities are scarce. Again, green leaves have to be treated differently according to their texture, coriaceous leaves cannot be folded so easily as soft flexible leaves, and so on.

42. When pupation takes place on leaves, the pupal shelter may be made in any of the following ways :—

(1) The tip of the leaf is pulled down and the leaf folded transversely to its length—pupation taking place inside the fold. Fig. XXIV illustrates this.

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* *Vide Indian Forester, Vol. XXVI, p.* 516.

(2) A flap may be cut out of the edge of the leaf and folded over, pupation taking place inside the flap.

Fig. XVI shows this.

(3) A single leaf may be rolled up longitudinally, the cocoon being placed inside the roll.

One-half of the leaf may be thus rolled up, or in the case of a large leaf only a portion of the edge rolled in, or, finally, in the case of a small leaf both sides may be rolled in towards the midrib, the larva pupating along the midrib.

To make the shelter secure, the hollow end of the roll is sometimes closed by having the surface of another leaf fastened tightly over it.

Fig. XXI shows a leaf with both sides rolled inwards and Fig. XXII a leaf with only one edge rolled in.

(4) The surfaces of two leaves which overlap one another, may be joined together, pupation taking place between them.

Fig. XXIII shows this.

(5) Several small leaves may be tightly bound together in a variety of ways, the cocoon being made inside them.

Fig. XXV shows this.

43. When pupation takes place on the leaves of the plant on which the larvæ feed, the methods of constructing the shelter for the cocoon and the ordinary larval shelter are practically identical, and sometimes, as noticed above, pupation takes place in the larval shelter, all openings of course being closed up.

44. The cocoon is of white silk, somewhat roughly woven, the threads being further apart than is the case in the cocoon of *Pyrausta.*

45. When the larva pupates in the soil, a pupal chamber is made of silk and bits of earth bound together.

Fig. XXVI shows two such chambers.

46. It is perhaps as well to draw attention here to the fact that *Pyrausta* has been called the "Teak Leaf-roller." This appears to be a misnomer, due I believe to a confusion of *Pyrausta* with *Hyblæa. Pyrausta* does not appear to merit the appellation, either on account of the habits of the feeding larva, or on account of the way in which the pupal shelter is constructed, whereas the name might well be applied to *Hyblæa* for both reasons.

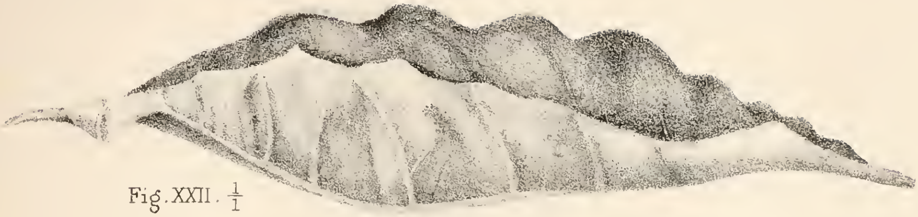


Fig. XXII. $\frac{1}{1}$

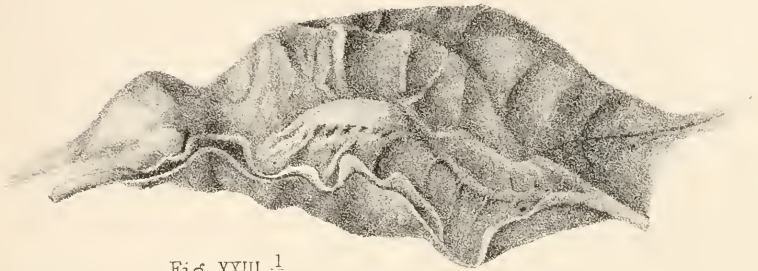


Fig. XXIII. $\frac{1}{1}$

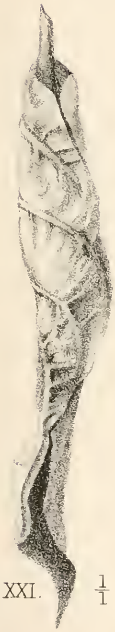


Fig. XXI. $\frac{1}{1}$

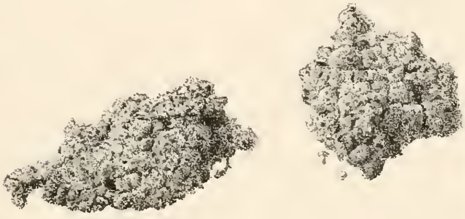
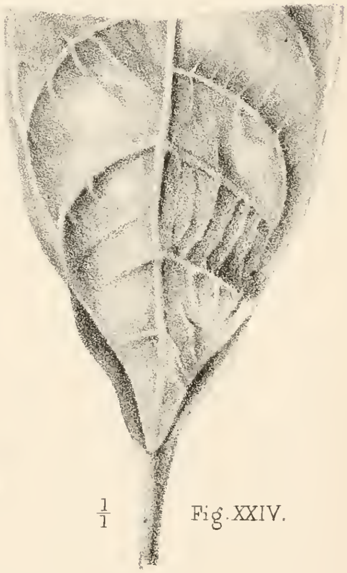


Fig. XXVI.



$\frac{1}{1}$ Fig. XXIV.

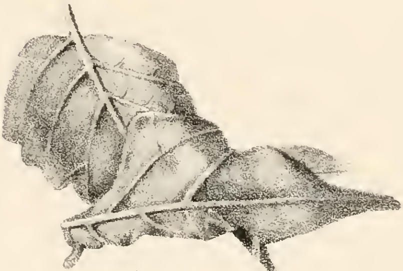


Fig. XXV.

NOTORIOUS INSECT PESTS

Figs. XXI, XXII, XXIII and XXIV show various methods of constructing the pupal shelters by Hyblaea puera *on leaves of* Habernaemontana coronaria

Fig. XXV. Showing a pupal shelter of leaflets of Millingtonia hortensis *made by larva of* Hyblaea puera.

Fig. XXVI. Showing two pupal chambers constructed in the soil by Hyblaea puera.

Mintern Bros. lith. London.

47. As noted above, the larvæ of *Pyrausta*, when feeding on the teak leaves, do not, as a rule, roll up the edge of the leaf, but lie on the exposed leaf surface below a light weft of silk thread. On the other hand this rolling of the leaf-edge to form the larval shelter is very characteristic of the *Hyblæa* larva when feeding.

48. Again, when about to pupate, the larva of *Pyrausta* usually takes advantage of the most convenient depression or cavity available within which to construct the cocoon. In the case of damaged, dead and withered leaves, the naturally curled-up edge forms such a cavity, and pupation in consequence often takes place in it. Here, however, the rolling of the leaf is primarily due not to the insect but to natural causes. That this is so, is also shown by the fact that, when the *Pyrausta* larva pupates on *green* teak leaves, pupation in the rolled-up edge is quite the exception. In this case, naturally curled-up edges are rare and the larva consequently makes the best of a depression along the midrib or a lateral vein, making the cocoon there by drawing the sides of the leaf loosely together by threads of silk.

The *Hyblæa* larva, on the other hand, when it pupates on the leaves on which it has been feeding, constructs the pupal shelter in the same way as the larval shelter which, in the case of teak leaves, is usually by rolling up the end or edge of the leaf.

49. Further it appears probable that when, as is often the case, the larvæ of both *Pyrausta* and *Hyblæa* are feeding together on teak trees, the larvæ of *Pyrausta* will sometimes utilize the empty larval shelters made by the *Hyblæa* larvæ and vacated by them, as convenient places for pupation. Any one casually finding the *Pyrausta* larvæ or pupæ in these shelters, under the curled-up leaf edge, would be apt to conclude that the rolling was done entirely by *Pyrausta*, whereas the *Hyblœa* larva is probably responsible for it.

50. For the above reasons I think the term "teak-leaf roller" is, as applied to *Pyrausta*, a misnomer which is apt to give an incorrect impression regarding the habits of the larva.

IV. PERIOD REQUIRED FOR ONE COMPLETE GENERATION.

A. *P. machœralis*—

51. Although I have made several attempts with more than fifty imagoes, I never succeeded in obtaining eggs from the moths kept in captivity. The life of the imago is, however, a short one and does not, as a rule, exceed 8 days. All eggs, also, found by me on the leaves of

teak trees hatched in from three to four days. The period from the pairing of the moths to the emergence of the larvæ from the first eggs laid by the moths does not, I believe, exceed 7 days. The larval stage lasts 2 to 3 weeks, the average time being 16 days. The pupal stage occupies 5 to 9 days, the average being 7 days. For a complete generation, therefore, about a month is required as follows:—

From pairing of moths to emergence of larvæ ...	... 7 days.
Larval stage	... 16 do.
Pupal do.	... 7 do.
Total	... 30 days.

B. *H. puera*—

52. The average period is also about one month, as noted in the case of the generations bred by me, as follows:—

From pairing of moths to emergence of larvæ...	7 days.
Larval stage	... 13 do.
Pupal do.	... 9 do.
Total ...	... 29 days.*

In the few cases for which I was able to obtain accurate dates, the moths lived from 7 to 9 days. The eggs usually hatch in 3 to 4 days.

V. Overlapping of the Generations.

53. In the case of both species the generations overlap one another more or less.

Of the imagoes of *Pyrausta* which ultimately developed from the hibernating larvæ bred by me in 1900-01, the last one appeared 20 days later than the first one. Hence the early larvæ of the first complete generation of the year get a start of at least 20 days over the later larvæ of the same generation. The same thing probably happens in the case of *Hyblæa*, and in this species I also found that egg-laying continued for several days, the first larvæ of each generation appearing some time before the later larvæ of the same generation. In the case of both insects, therefore, all stages of development may be found at one and the same time. As a rule, this is most noticeable in the case of *Pyrausta*, owing probably to the fact that this species usually occurs in far greater numbers than *Hyblæa*.

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* It must be understood that the period here given for a complete generation of *Hyblæa* refers to cases in which the larvæ were bred on the leaves of *Millingtonia hortensis*. The larvæ probably require a longer period to develop when they are fed on teak leaves.

VI. HIBERNATION.

A. *P. machœralis*—

54. The insect hibernates in the larval stage. Hibernation commences about the beginning of November and lasts about 22 weeks. When about to hibernate, the larvæ leave the trees on which they have been feeding and construct cocoons, in which the hibernating stage is passed, usually, if not always, in the ground. The hibernating larvæ are often found in clusters under large stones, and where there are no stones I have found them at a depth of several inches in the ground.

At the end of the hibernating stage, pupation takes place inside the cocoon, the pupal stage occupying the usual period of about 7 days, and the moth appears in April.

B. *H. puera*—

55. I was unfortunately not able to discover how or where the insect hibernates, but it is probable that it hibernates in the larval stage in the ground. This, however, of course requires confirmation.

VII. NUMBER OF GENERATIONS IN THE YEAR.

56. In the case of both species the first severe larval attack of the year noticed by me was in June-July, and the larvæ leave the trees about November. During this period one generation succeeds another without intermission, providing only that there is a sufficient food supply for the larvæ, the number of generations passed through being four to five. In Madras and Burma severe larval attacks have been reported as early as April, and here the number of generations passed through in one year appear to be seven.

57. I have already mentioned in para. 18 above that, in the case of *Pyrausta*, the first moth among those bred by me appeared, at the close of the hibernating stage, on April 7th. Allowing a month for one complete life cycle, we should expect the moths of the first completed generation of the year to appear on May 7th, which practically agrees with what has been recorded regarding the first appearance of the larvæ in Burma, for Major Bingham has noted* that he collected larvæ towards the end of April 1892 in the Rangoon Division, from which the first moths were obtained on May 6th. In the case of the dry teak forests of the Central Provinces, however, the larval attacks do not commence in April, for the simple reason that the teak trees are then leafless, the full foliage not appearing until June-July. During the period April-June, therefore, a few larvæ may survive on the trees

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* See *Indian Museum Notes*, Vol. III, No. 2, p. 93.

in damp situations, on which the young foliage first appears, or else they must live during this time on some species other than teak, but personally I have not found the larvæ feeding in this interval.

RELATIONS TO THE FOREST.

58. The economic importance of these insects consists in the enormous damage done by them to the teak forests, throughout India and Burma. Every year the larvæ of both species may be found, in or near the teak forests, from June to November and in many places from April to November. The number of generations passed through in the year is large, and in favourable localities amounts to as many as seven, any one, or all, of which may contain a sufficient number of individuals to entirely defoliate the teak forests in which they occur, and every year one or several more or less complete defoliations, extending over areas of various extent, and caused by one or other of these pests, or by both together, is reported from some part of India or Burma. These widely-spread, continually recurring, wholesale defoliations result in an enormous loss of annual wood increment in the teak forests, and must, to some extent, affect the vitality of the trees and their power of producing seed. The trees which have been completely defoliated put out another flush of young leaves, and it is probable that the continual stoppages in growth caused by these defoliations, followed by flushes of fresh leaves and renewed growth, produce several narrow rings of wood in the year.

The occurrence of zones of very narrow rings in teakwood has long been known to be a fact, and various explanations have been given from time to time. In 1901 I suggested* the attacks of these insect pests as a possible explanation, which, however, still remains to be proved.

59. In the dry forests, to which these notes refer, teak areas which have been absolutely defoliated by one generation of the insects are not attacked by the larvæ of the immediately succeeding generation. The reason is that the teak here require at least a month to renew their foliage after defoliation, and all moths which appear after the defoliation has been completed, finding no green leaves on which to lay their eggs, leave the defoliated forests and fly to other areas where the trees are still in leaf and lay their eggs there.

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* *Vide Indian Forester* for August 1901.—" Irregularity in the Growth of Teak."

Thus, in this locality, the same teak trees are not, as a rule, defoliated more than twice in any one year. This, however, of course depends on the local conditions of climate, &c. From the above it is clear that the development of a large number of larvæ in any one generation, in places where the food supply is limited, is prejudicial to the development of a large number of individuals in the immediately succeeding generation.

60. So far as *Pyrausta* is concerned, the larval attacks are certainly more severe in pure teak forests than in mixed forests.

61. In the case of *Hyblæa* it has been shown above that the natural food plant of the larva is apparently not teak, but plants belonging to *Bignoniaceæ*, also that the larvæ find some difficulty in adapting themselves to a teak-leaf diet, and that the larval development is, at first at all events, if not later, slower on teak leaves than on the leaves of *Millingtonia hortensis* for example. Generally speaking, then, mixed forests, containing a large proportion of plants belonging to *Bignoniaceæ*, would be more favourable to the development of the insect than pure teak forests would be. In the former, also, a certain number of larvæ would be kept alive on food which suits them best, in years which are unfavourable to the development of the insect on a large scale.

62. Of course in years when the insect is present in large numbers and the favourite larval food runs short in consequence, teak, in common with several other species, is attacked, and once the insect becomes established in a pure teak forest, the number of teak which suffer will of course be far greater than would be the case in a mixed forest.

ENEMIES.

A. *P. machœralis*—

63. The larvæ suffer from the attacks of an ichneumon and also from what appears to be a fungoid disease. Leaf spiders also attack and kill the larvæ. Bulbuls are said to eat the larvæ, and I have often found large numbers of these birds in an attacked forest.

B. *H. puera*—

64. The larva is a voracious feeder, but the insect has, fortunately for the forest, some powerful enemies which account for its generally occurring in fewer numbers than the *Pyrausta*. It is very liable to a disease apparently caused by a fungus. The larva is usually attacked, but I have also found pupæ killed by it. The diseased larvæ and pupæ become discoloured, wet and flabby, being filled with a yellowish-brown liquid.

65. The larvæ are very susceptible to injury just before moulting or pupation, and, when breeding them, care must be taken not to handle them then.

66. The larvæ and pupæ, but especially the pupæ, are greedily eaten by birds which pull open the larval and pupal shelters. In Jubbulpore, in 1901, crows were particularly destructive.

Leaf spiders also kill the larvæ.

PROTECTION AND REMEDIES.

67. The circumstances of each particular case must of course decide to what extent other factors, such as the necessity of curtailing expenditure, or sylvicultural considerations, will permit of the adoption of the following suggested remedial and preventitive measures.

A. *P. machœralis*—

In the forest.

(1) Teak should be grown in mixed forests.

(2) A proportion of the larvæ of each generation always leave the trees to pupate on the dead leaves on the ground or in the soil, and apparently all, or practically all, the larvæ hibernate in the soil. Pigs should, therefore, be admitted to the forests throughout the year, and would probably destroy a large number of larvæ and pupæ.

(3) Insectivorous birds and enemies must be protected.

In the nursery.

(4) During the larval attacks the plants should be sprayed with arsenical compounds.

(5) Larvæ and pupæ should be collected by hand from the leaves of the attacked plants, from April to November. During this period also dead leaves should be left under the plants, as a large number of larvæ will pupate in them and will there be more easily caught and destroyed than they would be in the soil where, in the absence of dead leaves, they would probably pupate.*

(6) Large stones should be left in the soil, and these should be lifted, and a search made beneath them for hibernating larvæ from November to April.

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* It is, however, possible that in the absence of dead leaves a larger proportion of larvæ would pupate on the leaves of the attacked plants.

B. *H. puera*—

In the forest.

(1) Trees and plants, which are valueless from a forest point of view and the leaves of which are a favourite food of the larvæ, should be cut out and destroyed as far as possible.

(2) Insectivorous birds must be protected, as they are a powerful check on the increase of the insect's numbers.

(3) Undergrowth should be cleared, when this can be done without injuring the forest, and dead leaves allowed to accumulate under the trees.

A large number of larvæ will pupate in these leaves and in the soil, and if pigs are allowed in the forests, while the larval attacks are in progress, they will destroy large numbers of larvæ and pupæ.

In the nursery.

(4) Plants should be sprayed with insecticides.

(5) The ground should be kept clear of weeds and dead leaves from April to November. The larvæ will then pupate largely on the leaves of the attacked plants, and, being large and easily seen, can be collected from them by hand.

ON THE ORIGINAL HOME OF THE TIGER.

By Col. C. E. Stewart, C.B., C.M.G., C.I.E.

The ordinary idea of English people that the tiger was originally an Indian animal, is, I believe, quite a mistake. After careful enquiry, I have come to the conclusion that the tiger is a comparatively late intruder into India.

Firstly, after enquiry, I can discover no Sanscrit word for the tiger. If tigers had existed in India in the days when Sanscrit was a spoken language, there would be a name in Sanscrit for it, while there is only a modern Hindustani name. There is a Sanscrit word for lion, "Singha," which would point to the fact that lions were certainly more common than tigers in time long past. At present lions are not found in India, except a very few, which are strictly preserved in Goojerat, one extreme corner of India, though I will allow that lions were probably commoner than they are now in the olden time, though probably never very numerous.

I remember, when I first went to India, nearly 50 years ago, a lion being killed not very far to the southward of Allahabad, but this was even then a rare occurrence. I have studied the question of the habitat of lions and tigers in Persia, where I resided for a good many years. Lions are found only in the very south of Persia, near the Persian Gulf, and Arabia ; while tigers are only seen in the very north of Persia, near the Russian border, and especially near the Caspian Sea, on the north of Persia, and they are more numerous within British territory than within the Persian boundary, and tigers are more common in southern Siberia than they are anywhere in Persia.

Tigers are more numerous in cold countries. They are plentiful in Corea, which has a severe winter climate, and still more plentiful in the Island of Saghalion, belonging to Russia, and further north than Corea, and which has almost an arctic climate in winter. The tiger is mentioned by Marco Polo in his travels, but nowhere as an Indian animal, and I very much doubt whether tigers were found in India at the time Marco Polo visited it.

In the Sanscrit works, treating of the fighting between Rama and Rawun, the Demon King of Ceylon, though many animals are mentioned, such as bears, monkeys, and several others, I have been unable to find any mention of the tiger ; and the tiger is not found in the Island of Ceylon, though the leopard is ; nor is the tiger found in the larger Island of Borneo, which would seem to point to its only inhabiting the Islands of the Indian Archipelago, which it could reach by swimming. Thus it would seem that tigers did not exist in India before the time that Ceylon was separated from India. Tigers did not exist in the Island of Singapore until about 1809, when apparently they swam over from the mainland. Tigers are such good swimmers that they can cross a considerable body of water. I do not think any allusion to tigers in India can be found in the Greek historians. I should feel much obliged if anyone could find me such a reference.

In the monuments of the Assyrian Kings, and of the Kings of Persia, there are constant references to lion-hunts by those kings, but never allusion to a tiger-hunt. Of course there is an existing Persian word for tiger, but there is nothing to show that it is at all ancient.

My own idea is that the tiger was originally a purely northern animal, which has gradually extended southward. I fancy that no allusion to a tiger in India can be traced to a period anterior to the early Mahomedan conquerors of India. I should be much obliged to anyone who will help me to clear up this question. We, English, have so completely assumed the idea that the tiger is an Indian animal, that we have called him the Royal Bengal Tiger, though I firmly believe he is as much an intruder from the north into Bengal as we are ourselves.

(*The above appeared in the Proceedings of the Zoological Society of London in Vol. I of* 1903.)

NOTES ON THE HABITS OF THE HOOLOCK.

By Geo. Candler, (m. b.) Cantab.

The Hoolock (*Hylobates hoolock*) is one of the most interesting of the family *Simiidæ*, and is perhaps not so familiar to naturalists at home as are some other members of the family, as, owing to its extreme delicacy and the great difficulty experienced in keeping it alive in confinement, it does not often find its way into European collections. Even in the Calcutta Zoological Gardens it is difficult to keep Hoolocks alive for any length of time. They often succumb to pneumonia, or if they escape actual disease they mope and die from the effects of confinement, or possibly from deprivation of some article of diet which in the wild state they have been accustomed to. I have ventured, therefore, to submit to the Society these short notes, made from the point of view of a field-naturalist rather than from a scientific aspect.

The Hoolock is clothed all over with a fine soft hair, which, perfectly black in the male, in the female shows a greyish tint, especially over the back. This uniform dark colour is only relieved by narrow horizontal streaks of white hair above the eyes. The face, palms of the hands, and soles of the feet are devoid of hair, and here the black skin is smooth and finely wrinkled and as soft as the finest kid.

The hallux and pollex have a flattened nail, the remaining digits have the nail laterally compressed and resembling a claw.

There is no tail. Ischial tuberosities and cheek-pouches are absent.

When the ape is sitting, the vertebral column presents a single marked curve with the convexity backwards. On the ground the Hoolock has a very characteristic gait. He goes along in a sort of shambling waddle, with legs bowed and knees bent, the soles of his feet applied flat to the ground with the hallux widely abducted, both arms being carried upwards and extremely abducted as if to balance himself. He cannot get up any speed, and invariably swings up into the first tree he comes to, where his movements are suddenly changed from extreme awkwardness to extraordinary grace and agility.

He swings along to the thinnest part of a bough, or to the slender end of a bamboo, until it bends to his weight, then with a swing and a sort of a kick-off he flies through the air, seizing another bough and swinging along it with the unerring accuracy of a finished trapeze performer. I fancy he does very little walking in the wild state, for I have never seen a wild Hoolock on the ground. Moreover, they are only found in the dense jungle where the ground is everywhere covered by tangled vegetation. It is puzzling to me why these anthropoids, being so entirely arboreal in habit, should be lacking in such a useful appendage as a tail. I think, at any rate, that it points to the fact that the apes have been developed along a line distinct from the monkeys, the earlier traces of which line are yet to be discovered.

The Hoolocks are extremely shy, and it is most difficult to watch them, as they are concealed by leaves high up in the tops of the bamboo-clumps or forest trees. You may hear their cries all round you as you ride quickly along a jungle-tract, but the moment you leave the path or look up at them there is a dead silence and scarcely a leaf stirs, until, tired of waiting, you move on again.

The cry of the Hoolock is a characteristic sound in the Cachar jungle. It is a very pleasing note, rising and falling in intensity, and reminding one somewhat in its rhythm of a pack of beagles giving tongue on a scent which is waxing and waning in strength, as a larger or smaller number of the band join in the chorus. It is heard chiefly in the early morning, then all through the heat of the day there is silence, but towards evening, as the sun sinks, you may hear it again. Hooloo ! Hooloo ! Hooloo ! with the accent on the Hoo syllable, is supposed to describe the sound, but it is really quite indescribable in writing.

As in other species of apes, there is a special modification of the larynx, which acts as a sort of resonating-box, and helps (I suppose) to make the sound carry, as it does, long distances. There is also a peculiar arrangement of the upper aperture of the larynx, with its small and inadequate looking epiglottis, which more resembles the arrangement in birds than the leaf-like epiglottis in man.

As, day after day, I have ridden through the jungle, it has seemed to me that the Hoolocks work their ground systematically in their search for food, just as the planter plucks one section of his tea to-day and another section in a distant part of the garden to-morrow. For I have found them filling the air with their cries along a particular stretch of jungle-road one day, whilst the next day not one was to be heard ; then, perhaps, a week later they are back again in the same place. Living as they do in communities, they are constantly on the move, and from what we know of their great intelligence, it seems to me highly probable that their movements are guided by very definite plans, and that very probably they have some sort of government system.

There is a point about the Hoolock that strikes me as very extraordinary and that is the fact that he cannot swim. I had been told this by both natives and Europeans, but I confess I was somewhat sceptical about it until I tried experiments myself. We put a full-grown Hoolock into a big tank in 10 feet of water. He struggled helplessly, as a boy would before he learns to swim. He sank twice, with head thrown back and arms waving frantically, and we were obliged to rescue him almost asphyxiated and choking in the most human way.

This weakness he shares with man, but I do not know whether (or not) it has been noted in the other anthropoids.

It is a significant fact that the range of the Hoolock is bounded by two vast rivers, the Brahmaputra on the north and the Irawaddi on the south. It may well be that, with his natural aversion to water, these rivers have confined him to the comparatively limited stretch of country he occupies. Travelling high up in the jungle, he could swing easily across the ordinary streams which would come in his path without having to take to the water. The monkeys of India take readily to water, and it is a pretty sight to see them spring out from a lofty overhanging bough and drop, one after another, with a splash into the stream, and strike out boldly for the further bank.

In Cachar, where these notes were written, the tea-planters often keep Hoolocks for years, allowing them to run loose about the compound, and they are certainly the cleanest and most interesting pets imaginable, offering a very marked contrast in this respect to the red monkeys, which, chained to a pole are so common a feature in Indian compounds.

A Hoolock, to be tamed in this way, must be caught quite young, and not tied, or shut up in any way. A native boy is generally told off to watch him for a few days, and to prevent him from bolting, but he soon learns to come down from the trees for a plantain, and he will in most cases settle down to a solitary life, remaining about the same compound for years. But chain him or restrain his liberty in any way, and he inevitably begins to mope and pine, and invariably dies in a few weeks. It is strange that the calls of the wild Hoolock, which he must hear almost daily all round him, do not tempt him to revert to his natural life as a member of a wandering community. I imagine a Hoolock, who attempted to join a strange band, would meet with a rough reception, any way they never try to return to the jungle after they become tame.

Several such tame Hoolocks I have had the opportunity of observing for some months past. Often they will be away up in the tree-tops for days together, when nothing will tempt them down, but when one chooses to be sociable he will come and sit on the arm of your chair at breakfast, and never reach or snatch things off the table: in fact, his manners are unexceptionable, and he keeps his skin beautifully clean without that exaggerated parade of flea-hunting which makes the monkey tribe so objectionable as pets. At sunset you may see him settle down to sleep, jammed tight in a fork in a squatting position. In this semi-domesticated state I notice that the Hoolock seldom uses his voice. I suppose, leading a solitary bachelor life, he finds no necessity for chattering or calling. With regard to the diet of the Hoolock, Dr. Blanford, the Indian naturalist, gives a long list, including fruit, leaves, young shoots, spiders, insects, birds' eggs and young birds. But, it seems to me, the diet of such shy creatures must be largely a matter of conjecture, for no certain conclusions can be drawn from the habits of captured specimens, nor can we recognize, as a rule, substances in the stomach of shot specimens, as we can in the crop in the case of birds. My own observations lead me to believe that fruits and the succulent shoots of young bamboos and other trees form the bulk of their diet. They will certainly catch and eat certain spiders; but I have invariably found them to refuse such insects as moths or butterflies, perhaps because many such insects have a bitter taste. Eggs, too, I found they would not eat. If you give an insect or a small bird to a Hoolock he will certainly pull it to pieces, and possibly taste or bite it, but it by no means follows that it is one of the regular dishes he enjoys in his wild life.

The following list of leaves and shoots which are eaten by the Hoolock is given by Anderson :—*Morugo pterygosperma*, *Spondias mangifera*, *Ficus religiosa*, *Beta vulgaris*, *Ipompœa reptans*, *Canna indica*.

I hope later on to supplement these short notes with some anatomical observations on weight of brain relative to body, and on the number and depth of convolutions. But this is a matter of time, for specimens are not very readily obtained. The Hindoo coolies, who form the bulk of the population in the tea-districts of Cachar, will never kill a Hoolock. The Kuki tribes in the Cachar Hills, on the other hand, kill and eat them, and regard them as somewhat of a delicacy, I believe. But even a Kuki finds it difficult to get a shot at these creatures, so shy are they and so active in their movements.

(*The above appeared in the Proceedings of the Zoological Society of London in Vol. I of* 1903.)

THE ANCESTRY OF THE HORSE.

As is mentioned in Sir W. H. Flower's well-known work on the horse, it has been urged that none of the modern representatives of the Equidæ can be descended from the three-toed hipparions of the later Tertiary period, owing to the circumstance that they lack any trace of the face-gland, or tear-gland, the cavity for the reception of which forms such a conspicuous feature on each side of the skulls of the latter. Many years ago Professor Huxley pointed out that the fossil horses of the Siwalik Hills in India, such as *Equus sivalensis*, do show a distinct vestige of the depression of the gland in question, remarking at the same time that they are the only species of *Equus* in which such a vestige is visible. This would be a *primâ facie* presumption that these extinct Indian horses are the descendants of the three-toed hipparions, of which numerous remains occur in the same formation.

Recently, while arranging a series of specimens in the Natural History Museum, I have detected a very distinct vestige of the cavity for the face-gland in the skull of an Indian domesticated horse sent home so long ago as 1845 by Mr. Brian Hodgson. The depression in this skull, which is now exhibited in the museum, stands out in striking contrast to the unbroken, flat, or rather slightly convex, surface of the portion of the skull immediately in front of the eye-skull in the case of other horses, asses, and zebras. It is, however, very remarkable that a distinct, although somewhat less deep, vestige of the gland cavity is noticeable in the skull of the race-horse Bend Or. It may be added that none of the skulls of horses from the brickearths and turbaries of this country preserved in the museum show any trace of the gland cavity.

Premising that I much desire the opportunity of seeing other skulls of Indian domesticated horses, and also those of Arabs, I think the following suggestions are justified from the facts at hand : Firstly, the extinct *Equus sivalensis* of India is descended from the three-toed hipparion of the same country, and that in turn it, or a nearly allied species, has been the ancestral stock (at any rate in part) of some of the Eastern breeds of domesticated horses from which our own thoroughbreds are descended, this theory receiving support from the occurrence of a rudiment of the face-gland cavity, not only in the skull of Mr. Hodgson's Indian horse, but also in that of Bend Or.

On the other hand, the cold-blooded horses of Western Europe are the descendants of a species which had lost all trace of the face-glands of the hipparion, and which was therefore widely different from *Equus sivalensis.* If this be true, our thoroughbreds belong to a species quite distinct from the *Equus caballus* of Western Europe.

To pass from details of structure to peculiarities of colour, the dun-coloured breed of pony so common in Kathiawar has become well known in zoological literature ever since the publication of *The Origin of Species* on account of the frequency or constancy with which it exhibits zebra-like markings. Darwin himself apparently never saw one, and I am not aware that a living specimen has ever been brought to this country, while I think it may be safely asserted that hitherto there has been no example in any of our museums. Accordingly it is satisfactory to announce that a specimen has been presented to the British (Natural History) Museum by the superintendent of the civil-veterinary department at Ahmednagar, Bombay, and is now exhibited to the public in the north hall of that building. On examination the specimen proves to be of even more interest than was expected.

Quoting from an Indian correspondent, Darwin stated that the Kathiawar ponies are not considered pure bred unless they show striping. The spine, he writes, is always striped, the legs generally show transverse barring, and in many instances one, two, or even three shoulder-stripes may be present, while the sides of the face may be also striped. It is added that the stripes are always most conspicuous in the colts and that they may disappear in the adult.

The museum specimen (which stands about 14 hands) is a bright yellow dun with a dark brown mane and dorsal stripe, the latter being continued down the tail. The hairs on the sides and upper part of the tail are coloured like the back, but the remainder is dark brown. Very noticeable is the circumstance that for some inches below its origin the upper surface of the tail is very sparsely haired—that is to say, so far as long hairs are concerned. The under parts and muzzle are coloured much like the back. On their front surfaces the limbs are blackish brown from the knees and hocks downwards, as they also are on much of their outer sides. Above the dark part barrings are distinctly visible on the hind surface of the fore limbs and on the inner side of the hind pair. There is no trace of a shoulder stripe, but certain dark mottlings on the sides of the face may be regarded as remnants of stripes.

There can be little doubt that the aforesaid markings are the last vestiges of a striping which was once complete, but was lost when the ancestral form of the horse took more completely to a life in the open plains; and from this it follows that dun is probably the primitive colouring of the horse. But there is another point of special interest in connection with this specimen. Those who have seen the Mongolian wild ponies in the Zoo or in Woburn Park will not fail to be struck by the marked resemblance presented to those animals (especially the ones in which the muzzle and under parts are darker than usual) by the Kathiawar pony. It is true that the latter is somewhat taller and more finely built, while it has a much shorter and sleeker coat. Such differences are, however, only what we should expect to find in a domesticated breed inhabiting a hot country. In addition to colouring (and it should be mentioned that the

Mongolian ponies display leg-striping when in the summer coat), a marked resemblance between the two forms is noticeable in the sparse hairing of the base of the tail.

There can, indeed, be little, if any, doubt as to the near relationship of the domesticated Kathiawar pony to the wild pony of Mongolia, the former occupying, in fact, a kind of halfway position between the latter and an ordinary English pony. This resemblance, I venture to think, disposes for ever of the pretensions of *Equus prejewalski* to rank as a distinct species, and the question narrows itself as to whether we are to consider the latter or the Kathiawar pony as the ancestral type—that is to say, whether the Kathiawar pony is a domesticated form of the wild Mongolian pony, or whether the Mongolian pony is itself only a Kathiawar pony (or a nearly related breed with a white muzzle) run wild. It would be of interest if Indian readers could give any information as to whether white muzzles occur in Kathiawar ponies. I have seen them in English dun ponies.

R. L.

(*The above appeared in the Field on 28th November*, 1903.)

MISCELLANEOUS NOTES.

No. I.—THE MEASUREMENTS OF THE LARGEST PAIR OF INDIAN BISON'S HORNS (*BOS GAURUS*) IN THE POSSESSION OF THE BOMBAY NATURAL HISTORY SOCIETY.

Length of Right Horn, round the curve	39″
Do. Left do. do.	39½″
Round the entire sweep of both horns	93½″
Circumference of Right Horn, at the base...	20½″
Do. Left do. do.	20¾″
Space between the tips, straight across	18½″
Inside span	35½″
Outside span	43½″

According to Mr. R. Lyddekker,* the gaur's head in this Society's Museum, the measurements of which are given above, is the largest specimen on record. The animal is said to have been killed by wild dogs in Salwen in Burma, and was presented to us by Mr. A. J. A. Jardine in 1897.

W. S. MILLARD,

Honorary Secretary, Bombay Natural History Society.

No. II —THE FOOD OF THE COMMON KRAIT (*BUNGARUS CANDIDUS*).

I append another incident in further support of the belief that kraits subsist mainly, if not exclusively, upon other snakes.

A warder in the jail here whilst going his rounds last night encountered a krait (*Bungarus candidus*) which he captured in the act of devouring some creature. A small portion of a tail was at the time protruding from the mouth. I killed the snake which measured 2 feet 7¾ inches, and upon investigation found it contained an adult *Lycodon aulicus*, 1 foot 6¼ inches in length. This latter was swallowed head first and lay at full length within the krait, the tail-tip being about 5 inches from the mouth. The head and forebody were in an advanced state of digestion, but the caudal extremity, including about two-thirds of the body, appeared to be quite unaffected by the digestive process. It was especially interesting as the victim proved to be a female, heavily pregnant with four eggs which I judged to be very nearly matured. These were very elongate; one, which was typical of all, measured 1⅜ inches by ⅜ inch.

F. WALL, CAPT., I.M.S.

CANNANORE, *January* 20*th*, 1904.

No. III.—THE FLAMINGO (*PHŒNICOPTERUS ROSEUS*) BREEDING ON THE RANN OF CUTCH.

(*With a Plate.*)

A note on the subject of the flamingo breeding in India, sent by Capt. C. D. Lester, appeared amongst the miscellaneous notes printed in the Bombay

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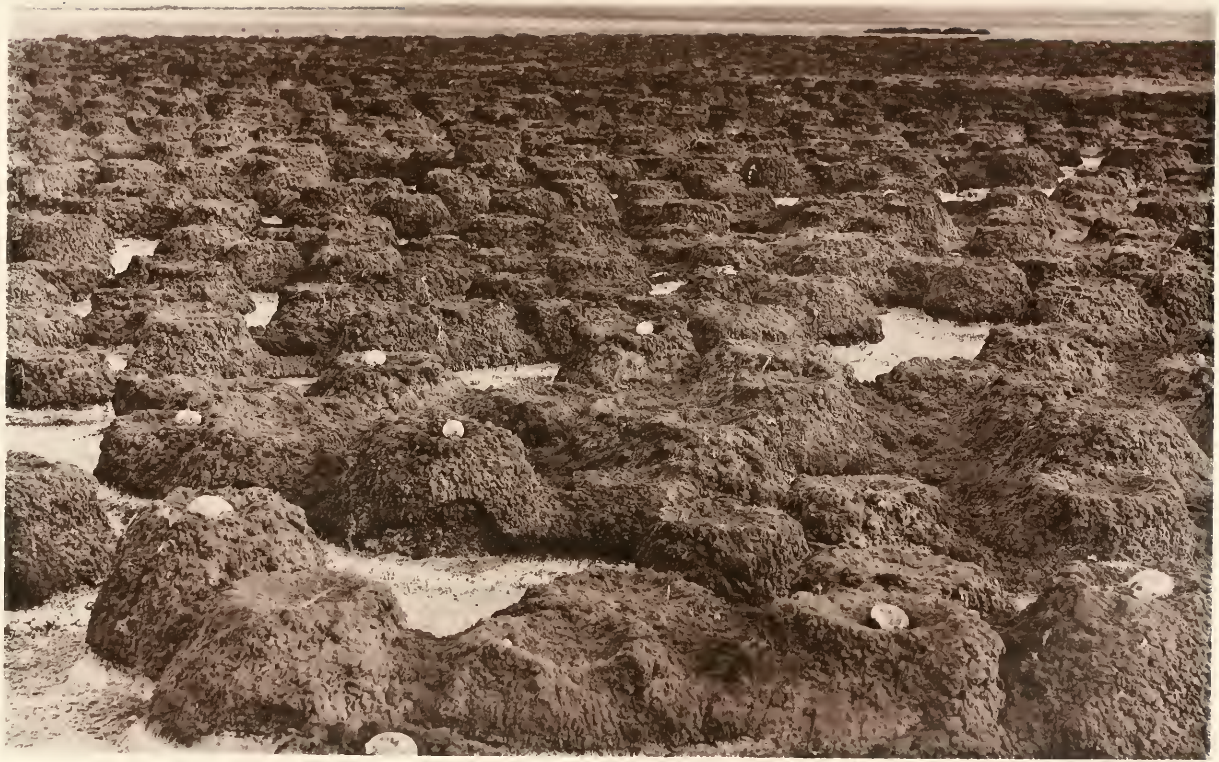
* The Great and Small Game of India, Burma and Thibet by R. Lyddekker, F.R.S., F.Z.S., F.G.S., 1900.



Mintern Bros. Photo-inp London

NESTS & EGGS OF THE COMMON FLAMINGO.

Natural History Society's Journal, Vol. VIII., No. 4. Since then I have more than once made inquiries to find out if the larger flamingoes continued to breed on the Rann of Cutch. It appears that they breed fairly regularly on the Rann, except in seasons of a scanty rainfall, when there is very little or no water lying on that tract, as has been the case during the recent years of scarcity and famine, or when the rains do not arrive until very late in the year. Their nests, which are built of earth while the earth is wet, are not made on any particular island; but the birds seem to select ground slightly higher than the surrounding country and covered with shallow water on all sides to a considerable distance from the spot selected, evidently so as to be free from danger from jackals, wolves, &c. It would be worth knowing if the flamingoes in seasons which they find unfavourable for nesting on the Rann seek other safer breeding grounds and, if so, whether they breed then on the Mekran Coast or elsewhere, or whether in such years they do not nest at all. A few of the birds are always to be seen in these parts. This year a large number of eggs and three young birds not fully fledged have been brought to me. I have also had photographs taken of the nests, which I send as they may prove of interest. The place on the Rann where the nests were found is about eight miles to the north-east of the Pachham, and here the nests were to be seen in hundreds.

The photograph was taken on the 6th November 1903, but the birds breed earlier than that. The eggs found on the nests were all bad ones.

RAO KHENGARJI.

BHUJ CUTCH, *January* 1904.

In the Fauna of British India, Birds, Vol. IV., page 409, Mr. Blanford expresses some doubt as to whether the common flamingo does breed in the Rann of Cutch, so that the above note by His Highness the Rao of Cutch, together with the photograph supplied by him (which is here reproduced), supplies us with conclusive evidence on this disputed point, and is of the greatest value.

EDITORS.

No. IV.—TIGER *versus* BEAR.

Last hot weather I visited some haunts of the gaur in the hopes of adding another to the list of those slain. On the way to the camping ground I was tramping along a jungle path on the edge of a water course, and arrested my steps on seeing some tiger droppings. It is my invariable rule on such occasions to make an examination in the event of anything of interest being discovered. In this particular instance my curiosity was fully rewarded. Two bears' claws and the remains of the beast's pads, entirely indigested, were extracted. One of these claws I send for identification. My opinion is that it belonged to a member of the species *Ursus malayanus.* Several days later, quite by accident, I hit upon the scene of the fray. My attention was first attracted by the appearance of the claw marks of a bear deeply indented in the soft bark of a tree overhanging a pool of water. There were unmistakeable signs of a severe scuffle in close proximity. Black hair tending to white at the tips littered the ground in clumps, clearly indicating that the victim was not overcome without making a good fight for his life and liberty. Though I searched for the skull, I could not discover its whereabouts. The tiger must have been, in the first instance, extremely pressed by hunger to tackle this somewhat formidable antagonist. Though the Malayan bear is diminutive in size, it can use its claws with great effect, and we can but surmise that the tiger obtained some nasty scratches before he had proved the victor. It is most probable that the bear was pounced upon unawares after having descended from the tree. The tiger, too, must have felt somewhat uncomfortable till he had got rid of the remains of his ursine meal. The spot where the bear was devoured was high up on a mountain-side and some five miles from the place where I picked up its claws. Are there other instances of a similar nature on record ?

W. H. LANE, Captain,
Indian Army.

Kalemyo, Upper Burma,
January 20th, 1904.

No. V.—LATE STAY OF SNIPE.

Last hot weather an orderly came to me one afternoon and brought news that in some paddy fields that had recently been flooded by Burmans a considerable quantity of snipe had congregated together. As I had thought to see no more of these birds that season, I was somewhat sceptical as to the truth of the report. The first time on which I paid these inundated fields a visit, I had ridden thirty miles in the morning ; but as two friends were arriving on the following day, I made up my mind to prospect the swamp and see whether it would be worth while giving them an outing. The following three excerpts from my shooting diary may be of general interest, not on account of the average number of cartridges per bird, for the shooting was very indifferent, but by reason of the dates and the size of the bags :—

March 29th, Kalemyo.—16 snipe, 1 redshank, 1 snippet (shot by mistake out of a whisp) ; self out. My gun did not arrive from Kalewa till 4 p.m., light very bad, and birds wild ; lost two more. Out of the last six shots only one bird was hit, which eventually settled in very high grass, but darkness interrupted the search. Expended 49 cartridges.

March 30th, Kalemyo.—M——B——and self out in afternoon. Total 14 couple. I was not shooting as straight as usual as guns walked too far apart and birds got up rather wild.

April 4th, Kalemyo.—Self out. Birds wild and day very hot. One of my boots fell to pieces. 19 snipe. 50 cartridges expended.

On the first day I could not have commenced shooting before 4-30 p.m., as the fields under water were a full mile from my bungalow. As the extract shews, the last few shots were fired in semi-darkness. This, coupled with the fact that I had just arrived from a 30-mile ride, was hardly conducive to straight shooting. The second effort on March 30th was rendered a failure by the other two guns constantly breaking the line in pursuit of flushed birds that had got up out of range and settled again at no great distance. April 4th was the best day of the three, and, had not the sole of my boot come off, the bag would have been larger. The heat of the sun was terrific, and it was almost an impossibility to keep the hands on the barrels after firing a right and left.

I did not again venture out after them as on the 13th April I was after gaur.

These snipe were evidently on their migratory trip northwards. Whether the flooded piece of land received new recruits every night between the above dates I am unable to state. Even in the heat of the day the birds were extremely wild, but there was no lack of numbers. I am positive they were not there for breeding purposes, as the area was far too much disturbed.

KALEMYO, UPPER CHINDWIN, W. H. LANE, CAPT., I. A.,
February 9th, 1904. *Burma Military Police.*

No. VI.—LATE STAY OF SNIPE.

In a recent number of the Journal (page 344) of this volume, Captain Lester has a note on the occurrence of snipe at Anmod, near Castle Rock, on the 7th, 12th, and 20th of April. I recollect falling in with some on a later date and at a point further South, namely, Honore (officially Honavar), in the North Canara District. On the 11th of April, 1889, I found a number of snipe in a small patch of rice in a sheltered valley, and shot four of them. Next day I got two in the same place. There were more, and I recollect that they seemed very tame; but I was shooting atrociously, and the area was so limited that they soon left it. Two years after, being in camp at Honore again, I went to the same spot on the 21st of April, but found only two birds. My impression at the time was that this was a place where seclusion and good fare tempted a few birds to defer their migration.

E. H. AITKEN.

KARACHI, *2nd March* 1904.

No. VII.—NOTES ON BIRDS' NESTING FROM POONA.

Having obtained a few good eggs since my last contribution to the Magazine, I venture to add a few more notes. Before so doing, I trust I may be pardoned if I make a remark or two solely on behalf of the Society.

Many members of the Society have remarked to me lately that the Journal was getting too scientific and that even the Miscellaneous Notes were getting beyond them, in consequence of which they were thinking of throwing up their membership. This is mainly due to the use of scientific names. It must be remembered that there are a large number of members who take interest in Natural History, but do not go into it deeply or keep books of reference. To such, scientific names convey no meaning. For example, there are many sportsmen who shoot small game. To these *Platalea leucorodia* would convey nothing; but when the English name Spoonbill is introduced, interest is awakened, as the bird is common and known to any person shooting duck or snipe. When only the scientific name is used, many members pass over the article as they do not know to what it refers. As soon as the English name appears, it is full of interest. It is not, therefore, expecting too much of contributors to the Miscellaneous Notes to ask them to use English names when possible and to thus attract and keep members.

THE BROWN CRAKE (*Amaurornis akool*).—Barnes in his "Birds of Bombay" states that the Brown Crake is not common in the Dekhan. I think he makes a mistake, as I have frequently come across it at Poona and other parts of the Dekhan; in fact, should call it common. I have heard a shrill rattlelike call, frequently emanating from a sugarcane field or some such similar locality, which I attribute to this bird. I cannot be certain, as I have never caught the bird in the act of calling; but if my surmise is correct, I should say the bird was abundant. Like all birds of this class, its habits are lurking: it haunts swamps, water, thickets in the vicinity of water and such like places. It may be seen on occasions walking along a path, jerking its tail or scutling across a bit of open ground to cover. It is not over difficult to flush, though not a strong flier. I found three nests round Poona last year—one on the 29th August, with six fresh eggs, off which I shot the female for identification, and two on the 13th September with five and six slightly incubated eggs each. The nests, mere pads of grass, well concealed, were placed on little raised tussocks of grass in a swamp. The best way to discover the nest is with a line of beaters; as the line approaches the nest, the hen, a close sitter, slips off, and either runs ahead, looking like a rat, or flies a short way. If search is made, a nest is usually disclosed. The eggs are of whitish colour, covered with purplish or brownish red spots, streaks and splashes.

THE BALD COOT (*Fulica atra*).—In 1902 I found no nests of this bird. In 1903 I came on many. The ground searched was the same as that in 1901. I merely record the fact, as I do not think the Bald Coot breeds habitually in India, but only occasionally.

THE BLACK-WINGED KITE (*Elanus cœruleus*).—After many years of birds' nesting, I have at last taken the eggs of this bird myself. It is said to have been common round Poona about 1876. I have found it rare. On the 7th September 1903, I came on a couple of these birds in grass land, studded with mango trees, half grown, and watched them. They are rather fascinating in their movements, being very restless, flitting from perch to perch, hovering a moment, dropping on some insect in the grass, uttering their whistlelike call—in fact, being continuously on the move. I thought they were nesting as they appeared more restless and anxious than usual, being decidedly aggressive to all winged creatures. After a short period, one disappeared. I began searching round, and presently noticed a crow-like nest in a small mango tree, on tapping which out flew the bird. There were four partially incubated eggs. On 26th January 1904, I found another nest below the Mhaswad Tank Bank. There were only two eggs which I left for three days, but as no more were laid, I took them. Somehow I think they were addled. The nest was in a small sapling and the bird on it. It looked absolutely new, being lined with fresh stalks of grass.

The Spoonbill (*Platalea leucorodia*), the Indian Shag (*Phalacrocorax fuscicollis*), the Smaller Egret (*Herodias intermedia*), and the Black Ibis (*Inocotis papillosus*).—I had rather a find of these birds. During a recent tour I stopped at Rajewadi on the Mhaswad Tank, about fifty miles due east of Satara. This is an enormous stretch of water, but little did I think that I should obtain water birds' eggs at this time of year—January. I soon noticed a single tree, standing well in the water, laden with nests. On visiting it I found nests of the first three on it: each sort seemed to keep to itself. The Spoonbills all had young, but I obtained eggs of the other two. The Smaller Egret's, four in number, partially incubated, while the Indian Shag's contained four, five and six eggs each. Although I put the birds off their nests, I think the eggs of the last mentioned were very suspicious as they shook in their shells. The nests of all three were very similar, except that the Egret's were smaller. The tree and nests were indescribably filthy, being white with droppings, looking as though they were covered with hoar frost. The nests were alive with vermin, and some had a dead bird or two to add to the accumulation. I am sure they are not possessors of Sanitary Commissioners or Associations. On my climbing the trees, all birds that could fly left it, and there was a general uproar. The tiny young, incapable of moving, remained still; the rest began scrambling over each other and showing a wonderful amount of agility. I was afraid they would be precipitated into the water: not a bit of it, they hung on as tenaciously as monkeys. I came on several other trees, similarly situated, with many Spoonbills' nests, and I got four clutches containing three eggs each, except one which had only two. These nests, however, were by themselves and not among the general crowd. It is curious why water-birds should breed in colonies; where trees are scarce, it might be understood, but when there are plenty standing in water, why they should pack together is hard to understand. It must be miserably uncomfortable to have no elbow room. Perhaps they think that their young require licking into shape by each other. This they apparently get, judging by the incessant squabbling and squawking that takes place and the way they tumble over each other.

I also got three eggs of the Black Ibis. There was a single nest in a tree standing in water, on which the bird was sitting. These eggs were quite bad. How long they had been laid cannot be said or why the bird continued to sit. One would think instinct would tell them that the eggs are "bad uns": these were even beyond the "election" stage. I consider I did the bird a good turn by taking them, as she would probably have died in her efforts to hatch them off.

The Painted Stork (*Tantalus leucocephalus*).—According to Oates, not many nesting places are known of the Painted Stork. I came on one at Dhakor, in Guzerat, some years ago, and have just struck another at Khatpal, about ten miles East of Mhaswad Tank, on the western borders of Sholapur. The colony consists, I should say, of some fifty or sixty couples. The nesting site was at the top of an enormous banyan tree. The nests seem small, but sufficient to fit the bird. I was afraid I should not obtain any eggs as some of the birds were building. However, on sending up a man I got several clutches of absolutely fresh eggs, 27th January 1904. Four appears the complement, though one nest contained five eggs. It seems odd why these ungainly birds should nest on the very tops of lofty trees. They do not look in the least at home, and appear to take all their time in trying to keep their balance, in doing which they give one the idea of being on a tight rope. It puzzles me why they should select this curious spot to breed in. The country round is dry and unattractive. True, there is a small tank close by, which always contains water and a nullah, choked with reeds, running handy. Probably these contain a good class of frog or other food palatable to the bird, which binds them here. The local people say they never migrate, but remain all the year round.

THE BRAHMINY KITE (*Haliastur indus*).—Within a stone's throw of the Painted Stork's colony I found a nest of this bird on the same date, containing one fresh egg. Although fairly common, I have not found many of their nests. They seem to retire to quiet and secluded retreats to bring up their young.

R. M. BETHAM, MAJOR.

POONA, *4th March*, 1904.

No. VIII.—THE HIMALAYAN NUTCRACKER (*NUCIFRAGA HEMISPILA*) AND OTHER WALNUT-EATING BIRDS.

I am sending for the Society's Museum two skins of the Himalayan Nutcracker, which I have collected and prepared, as these specimens are in much better plumage than the first I sent some time ago. I have also been able this time to secure both the male and female birds.

In my first account of the Himalayan Nutcracker, I mentioned that I had found it on the Mountains of Kullu at an altitude of from eight to nine thousand feet. Jerdon states that he had observed it at ten thousand. This year I have noticed the bird as low as five and six thousand. In fact, it follows the region of the *Pinus excelsa*, the seeds of which furnish it, to a great extent, with food.

I am glad of an opportunity of again bringing the Himalayan Nutcracker to the notice of the Ornithological Branch of your Committee, as in my first notice of it I stated that, during a certain portion of the year, its food consisted of wild walnuts, and I forwarded, with the specimen then sent, a string of walnuts, both shells of which had been perforated by the bird in a very regular manner. I felt certain of the fact I thus notified, because I made particular inquiries from no less than seven different hillmen who lived on the mountain on which I shot the bird, and they all told me that during the fruit season the Nutcracker lived principally on wild walnuts, in confirmation of which statement they brought me the doubly perforated shells, of which there was a quantity lying about under every walnut tree in the vicinity of my mountain camp. Upon my suggesting that the nuts had been opened in this way by a rat, the men ridiculed the idea, and declared that the bird, and nothing but the bird, with which they were quite familiar, had perforated the walnuts.

I saw in the Society's Journal, Volume 14, No. 4, published on the 10th February 1903, page 819, a notice of the *Nucifraga hemispila* by Mr. Osmaston, your Darjeeling correspondent, who criticised my former note in the following words :—

"With reference to a note by General Osborn on the Himalayan nutcracker (*Nucifraga hemispila*) which appeared on page 628 of Vol. 14 of the Society's Journal, I should like to make a few remarks.

It is stated in the above that the nutcracker perforates the shell of the wild walnut, and feeds upon the contents. This, I maintain, is a mistake.

The wild walnut of the Himalayas has an intensely hard shell which it would be quite impossible for any bird to perforate. Even the black bear finds it too tough a nut for his powerful jaws to crack, though he feeds largely on the cultivated variety with a thinner shell. The only animal, as far as I know, which can circumvent the excessively thick and hard shell of the wild walnut is a species of rat (probably *Mus neveiventer*). When stationed for some years in the North-West Himalayas (Chakrata), I constantly came across wild walnuts, with the round holes, described by General Osborn, bored in a systematic manner on either side of the nut; but the holes showed evident marks of the teeth of a small rodent, and though I never actually saw the rat at work, I think there can be little doubt but that he is the culprit."

Upon reading the above note by Mr. Osmaston, I thought it advisable to make still further enquiries as to the walnut-eating habit of the nutcracker, and to this end I asked my friend Mr. J. C. Carroll, Deputy Conservator of Forests in the Kullu Range, to make enquiries for me on quite a different mountain range in Kullu to the one I have mentioned, as to what bird or rodent is in the habit of thus perforating the wild walnuts. I may mention that Mr. Carroll is himself a good naturalist and ornithologist.

On returning from his forest tour, he brought me the information that, after careful enquiries, he found that the bird which bores into the walnuts is, without doubt, the Himalayan nutcracker. He further gave me a very interesting note, which I insert below, regarding the walnut-eating habit of the lesser spotted woodpecker (*Dendrocopus minor*), a much smaller bird than the nutcracker.

Mr. Carroll's Note.

"Your account of the perforation of walnuts by the *Nucifraga hemispila* is very interesting, and, as I told you, has reminded me of a similar habit which I have seen practised by the lesser spotted woodpecker.

I spent the summer in 1901 and 1902 at 'Kalatop,' the forest bungalow near Dalhousie, and was surprised to learn from the gardener that the fruit on a walnut tree near the bungalow never came to anything. He could give me no reason for this.

Later on in the summer, just as the walnuts were ripening, I was constantly hearing the tapping of a woodpecker, and on tracing the sound found that it came from the walnut tree referred to. I disturbed the bird, and found that it was a lesser spotted woodpecker. On hearing the tapping again, I went quietly under the tree, and closely watched the bird at work, boring into the nuts, first perforating the outer skin—an easy task—and then the hard, fully formed shell of the nut itself—a very different matter.

I secured some of the nuts, and found that the whole of the kernel had been eaten away by the bird. A large hole, sometimes nearly the size of one side of the nut, had been made, and the contents neatly scooped out.

I was at first under the impression that the attacks were made in search of some insect, but examination of nuts on which attacks had been commenced disproved this, for the bird had certainly excavated for the contents of the nut itself.

When I had made these observations, I gathered the nuts which survived, and found them all good, though rather small fruit, with very hard shells. I saw the same thing happen to the same tree in 1902."

Now we have seen from Mr. Carroll's note that the lesser spotted woodpecker is a great destroyer of wild walnuts, and, for further light upon this point, I extract the following from "Dr. Schlich's Manual of Forestry," Vol. 4, page 128, where the learned doctor discourses on the damage done by woodpeckers to trees and seeds.

He says *Dendrocopus major*, alone of the woodpeckers, eats large quantities of coniferous seeds. It wedges the cones which it has plucked in a cleft of the bark or in an angle between a stem and a branch, opens them out, and removes the seeds with its bill. One can distinguish between the action of the crossbill and the woodpecker in this respect. Frequently the ground under a tree is covered with opened out cones. Also *walnuts*, hazelnuts, acorns, and other fruits are eaten by the great woodpecker.

Here we have the valuable testimony of two very competent witnesses, both of them foresters, to the fact that the spotted woodpeckers, both great and small, find no difficulty whatever in extracting the kernels from walnuts. How much easier then must it be for the Himalayan nutcracker to do the same thing, he being a much larger and very much more powerful bird, with a bill built like that of the woodpecker, but much stronger in every way.

In connection with all these points, it is interesting to note that if you dissect the eye of a woodpecker, you will find that the sclerotic coat (in which is enclosed the soft portions of the eye, such as the crystaline lens, iris, vitreous humour, &c.) is very much stronger, thicker, more cartilaginous, and more absolutely horny than the sclerotic of any of the insect-eating, grain-eating, or fruit-eating birds. This extra strong construction of the eye of the genus picus is to protect its semi-fluid contents from being jarred and very possibly displaced by the shocks to which the head of the bird is subjected when the woodpecker is hammering away with its bill at the hard bark or wood of a tree.

Dissect the eye of a Himalayan nutcracker, and you will find the sclerotic coat similarly specialized, this formation being doubtless a provision of nature, as in the case of the woodpeckers, to protect the eye of the bird from damage and shock when the owner is battering away at pine cones, hard walnuts and other nuts. The inference, therefore, is that the structure of the eye of the nutcracker is a fair indication of its feeding habits, as regards nut-cracking, nut-piercing and walnut-boring, and even possibly tree-boring, for I have seen it on decaying pine trunks evidently searching for grubs and insects.

I have written these notes, not in a spirit of controversy, but simply to elucidate a doubted point in natural history, and to furnish, upon this very same point, information which appears to me to be sufficiently clear and reliable.

W. OSBORN, Lt.-General.

Osborn House, Naggar Kullu, Kangra District,
Punjab, 11*th March*, 1904.

No. IX.—NESTING OF THE HORNBILLS.

It is well known that the hornbills build their nests in hollows and holes, high up in forest trees, and that the male bird, when the hen is ready to sit, walls her up, and completely conceals her and her nest by plastering up the orifice of the hole with clay or mud, leaving only a small opening for her bill to protrude. He brings food for her daily, and she remains thus imprisoned till the young birds are ready to leave the nest. The reason for this curious habit has always been a mystery, to which, however, I think I have obtained a clue.

I ascertained some time ago, when a nest of the common grey hornbill (*Meniceros bicornis*) was discovered, that during the period of incubation and subsequent care of her young, the hen bird, while walled into her nest, as above described, had moulted the whole of the quill feathers of her wings and tail.

Now if it is the habit of the females of all of the hornbills to moult in this fashion during the time of nidification, it is evident that the bird, unable to fly, or in any way to retreat from her enemies, must become the prey of any marauding predatory bird or beast which happened to discover her. This, it strikes me, must be the reason why the hen hornbill is thus protected and concealed by the male bird (which probably moults irregularly) while she is incubating and bringing up her young brood.

The habit of moulting all of the quill feathers at one and the same time is common to some of the ducks, notably "The Spot Bill" (*Anas pœciloryncha*), and, I have heard, to some of the Australian swans. But this peculiar moult in the case of the hornbills, from the one instance that has come under my notice, appears to be confined to the female bird alone, and, under the circumstances described, the motive and necessity of the clever concealment of the nest become apparent.

I should like to see some more information on this matter of the female hornbill moulting as I have described. The habit must be common to all of the numerous family of the hornbills, else why should their nests be so peculiarly and ingeniously hidden?

Forest officers fond of bird life and sportsmen naturalists, who wander into the haunts of these birds, might be able to throw further light on this very interesting point, for this curious nesting habit is common to all the hornbills of India, Burmah, the Malay Peninsula, and Africa.

W. OSBORN, Lt.-General.

Osborn House, Naggar Kullu, Kangra District,
Punjab, 11*th March*, 1904.

No. X.—THE BLACK AND YELLOW GROSBEAK (*HESPERIPHONA ICTERIOIDES*).

I send for the Society's Museum a stuffed skin of the male black and yellow grosbeak which I shot at Naggar, Kullu, on the 1st of January 1904.

This handsome grosbeak is a winter visitant only to this part of the Himalayas, but it does not stay long. I tried to get a specimen of the female bird, the plumage of which differs considerably from that of the male, but could not succeed, chiefly owing to the short stay of this grosbeak in Kullu.

W. OSBORN, Lt.-General.

Osborn House, Naggar Kullu, Kangra District,
Punjab, 11*th March*, 1904.

No. XI.—OCCURRENCE OF THE WHOOPER SWAN (*CYGNUS MUSICUS*) IN SIND.

I am sending you for the Society's collection the skin of what appears to be a young whooper swan which was shot on the 31st January last on a sheet of water known as the Changra Dhand, in the Kambar Taluka, Larkana District. It was the only one seen.

As, I believe, only one other specimen has been obtained in Sind, the occurrence is worth recording.

J. CRERAR, I.C.S.

Larkana, Sind, 12*th February*, 1904.

Mr. Crerar is undoubtedly correct in his identification, and the occurrence of this rare bird is certainly worth recording. We have in our collection only one other specimen obtained in India, shot on the River Beas, in Hoshiarpur, and sent to us by General W. Osborn in January 1900.

EDITORS.

No. XII.—THE CRESTED HAWK-EAGLE (*SPIZÆTUS CIRRHATUS*).

I send you a specimen of this bird for the Society's collection, as, I think, its occurrence here is of interest. The specimen was shot by Capt. Pritchard at Chatrapur on the 7th instant. It had been seen about here since November, and had killed several of his fowls and chickens. Captain Pritchard informs me that he shot another here in 1895.

There are no forests within many miles of Chatrapur, and the nearest forests, twenty miles away, are thin scrub for the most part. I have not previously seen this bird so near the sea (within three miles) or so far from forests although it is not uncommon inland in the forest tracts of Gumsur.

C. E. C. FISCHER, I. F. S.

CHATRAPUR, GANJAM DISTRICT,
9th *March*, 1904.

No. XIII.—BIRDS BATHING IN CLOUDY WEATHER.

I daresay many people who have kept birds will have noticed that their pets choose to take their baths, not as one might expect on hot sunny days, but in dull overcast weather, when it is rather cooler than usual.

This has puzzled me for a long time. The only explanation I can find for it, and I cannot say it is one I am altogether satisfied with, is that in such weather evaporation is retarded, and the bird feels by instinct that it is less likely to take a chill.

Last Christmas Day, however, I noticed a circumstance which accentuates this curious habit.

It was a cold day and slightly overclouded. About half an hour before sunset I saw some sixty crows of two species (*C. splendens* and *corrone*), all busily engaged in splashing about in a shallow tank. Now what could have induced these birds to choose one of the coldest days in the year, and just before going to roost too, to thoroughly saturate themselves, I am at a loss to discover, and perhaps some of our readers can throw some light on the subject.

A. NEWNHAM, MAJOR.

LUCKNOW, *March*, 1904.

No. XIV.—NATURAL CHECKS ON OVER-INCREASE.

It seems to me an investigation into the above subject is one which would repay the trouble and bring to light many interesting facts. Out in India, where man, as a destructive agency, has probably less influence than in any other country in the world, we get things more or less in their natural state, and should be able to study the question under exceptional advantages. The particular phase of the subject mentioned in my heading, however, is the apparent absence of any check in the case of certain animals and birds.

For example, monkeys. Natives, of course, will not kill them, and few Europeans care to. They have no natural enemy to diminish their numbers, though panthers may occasionally catch them in wooded country. Take the ordinary case of monkeys in the plains, living near villages. They have abundance of food all the year round and apparently no natural check whatever to their unlimited increase, yet, as far as I can make out, one never hears of such an increase in their numbers as to make them a source of danger or serious damage to man's food supply, as, for instance, is caused by lemmings or locusts.

The Sadar Bazar here is full of monkeys, but from enquiries I have made I find their numbers have remained stationary. One possible explanation may be their family arrangements, according to which the lord of the harem allows no intrusions by the younger males. Yet this does not entirely explain it, for the same system prevails amongst many gregarious animals whose numbers are enormous in spite of many natural enemies. Monkeys are certainly subject to plague, but I have not heard of any serious mortality on this account nor by any other epidemic.

Turning to the bird-world, take the common parrot. Its numbers are incredible in certain districts—Guzerat, for instance—and they do a lot of mischief. But why are their numbers not even greater? Few birds of prey can catch a parrot. They roost in safety and nest in comparative safety, and food they must be able to obtain at all seasons of the year, otherwise they would migrate. Yet their numbers remain about the same, for one never sees in revenue reports any reference to a plague of parrots as a reason for a deficient crop. I think this is a subject on which the experiences and opinions of some of our members, scattered as they are over the whole of India, would be very interesting; and it is in the hope of calling forth such that I have broached a topic on which I personally confess to ignorance.

Lucknow, *March*, 1904. A. NEWNHAM, Major.

No. XV.—THE OCCURRENCE OF RARE BIRDS IN INDIA.

On the 7th instant a fine male specimen of the pink-footed goose (*Anser brachyrhynchus*) was brought to me by a native shikari The bird was one of a flock of about forty geese, probably not all of this species, and was shot on the banks of the Brahmaputra whilst working up stream preparatory to migration to North-East China. The colours of the soft parts were as follows:—Iris, red-brown; feet, brilliant crimson-pink; bill, brilliant crimson-pink; commissure of lower mandible, yellowish; nail, black, but the edges paler.

Mr. N. S. Mondy saw two birds, which he believed to be of this species, in a large gaggle of geese on a chur in the same river. He could not get near enough for a shot, but, even at the distance he was, the feet and bill were rendered conspicuous by their brilliant colour.

Mr. More shot two female ducks (*Anas zonorhyncha*) on the Sissi bheel on the 6th March. The birds were two out of a flock of about forty. It would seem, therefore, that *zonorhyncha* and not *pœcilorhyncha* is the typical form of spot-bill found in the extreme East of Assam. In Cachar, Manipore and Gowhatty the form is *pœcilorhyncha*.

E. C. STUART BAKER, F.Z.S.

Dibrugarh, Assam, 22*nd March*, 1904.

No. XVI.—A LARGE BAOBAB TREE.

In the Journal, Vol. XV., page 131, there is a note on a large *Adansonia digitata*, and, as I happen to be living at present in a compound in which seven baobabs grow, I have been induced to measure the largest, and find that two of them exceed the dimensions given by Mr. G. M. Woodrow.

The largest (at 4′ from the ground) measures 48′-2″ in circumference, and has an estimated height of 82′.

The tree is known as the largest in Madras, and is a magnificent specimen as you may see from the photograph sent under a separate cover.

The second largest tree measured at 4′ from the ground 35′-6″ and at 1 from ground level 39′-6″.

W. B. BANNERMAN, Lt.-Col., I.M.S.

St. Thomas' Mount, Madras,
2nd April, 1904.

No. XVII.—DOVES AT JULLUNDUR.

It may be worth recording that on two occasions recently, when riding down the Mall here, I observed, at the same spot, a dove (undoubtedly the same bird) which looked to me like a cross between *Turtus suratensis* and *Turtus cambayensis*. It was in the company of a pair of the latter, which with *T. risorius* are the common species of these parts. The bird seemed too small for *suratensis*, and, with the exception of the pale rufous-isabelline spots on the wing coverts, was in size and markings similar to *cambayensis*.

The occurrence of *T. suratensis* in the plains of the Punjab is, I believe, if not almost unknown, at any rate very rare, and this is certainly the first occasion on which I have observed it in these parts. It is, however, not uncommon in the Kangra Hills sixty miles North.

Unfortunately, on neither occasion had I a gun handy, and although I have since looked for the bird, I have not been able to find it again.

Jullundur, *February*, 1904. H. A. F. MAGRATH, Major.

No. XVIII.—THE OCCURRENCE OF THE MALAY FISH-OWL (*KETUPA JAVANENSIS*) IN ASSAM.

I have to record the appearance of *Ketupa javanensis* in this district, a fine female having been shot a few miles from here on March 23rd. At first sight I mistook it for *K. zeylonensis*, but on comparison with that bird the smaller size and absence of cross barrings were very evident. This is, I believe, the first record of *K. javanensis* in Assam.

Margherita, Upper Assam, H. N. COLTART.
April, 1904.

No. XIX.—FLY-FISHING IN THE BOMBAY PRESIDENCY.

MEGALOPS CYPRINOIDES AS A FLY-TAKER.

(*With a Plate copied from Thomas' "Rod in India."*)

Fishermen are almost bound to welcome any information which, in any way, tends to add to the number of fly-takers in Indian waters. A *good* fly-taker is assuredly a *rara avis*, and in *Megalops* I have recently found a creature of the required "gentlemanly tendencies."

Last rains it was decided to "stock" the tank close to the Government Officers' Bungalows at Alibag. *My* object in doing this was to try and secure some sort of fishing—the sea having failed me—during a time of the year when existence is somewhat marred by monotony and generally damped by about 100 inches of rain. The other objects were to secure a greater purity in the water-supply and to keep the mosquito larvæ from establishing a needless monopoly. Thus it came about that I put in 1,000 fry of various sorts, including, to my knowledge, the *Lates calcarifer* ("cock up"), *Chela argentia* ("chelwa"), *Barbus filamentosus* ("the black spot"), and *Macrones chryseus* ("shingali"). At that time I had not recognized our present "friend-in-need" the *Megalops.* I took him, I remember, for a little carp, but felt, at the same time, uncertain as to his precise identity. This selection of fry will not be considered a very judicious one by the expert, but it was the first time I had ever attempted to "stock" a pond, and the all-pervading desire was to get the fish in. The *Lates calcarifer* and *Macrones chryseus,* as is well known, are essentially sea and estuary fish ; but they appear to thrive quite as well as the *Megalops,* whose true home and abode is the adjacent sea water.

The water in the tank is rapidly drying up now, and the welfare of the fish is somewhat at stake. But it is hoped that the remaining two months may be somehow tided over. So much for the actual history of the fish placed in the little tank referred to here. What I ventured to sit down to draw very particular attention to was, however, the marvellous "fly-taking" propensities of this fish. During the last three or four days they have displayed a more pronounced inclination to rise about sun down and continue to do so until it is dark. The fish are magnificently coloured and very game. We have used throughout small "chelwa" flies supplied by Luscombe, and have secured several specimens every evening. If one recollects that the fry were only put in last July, when about 3″ in length, and that they now attain ¼ to ½ lb. in weight and measure 10″, their rate of growth, in strictly circumscribed circumstances, is one of the most satisfactory features about an altogether satisfactory fish. Their habit of leaping right out of the water when hooked requires very careful manipulation and adds to the sport. The local vernacular name for the fish is "Warus," वरस, and they are known by the same name all down the Rutnagiri Coast. The fish is described in page 214 of Thomas' "Rod in India," wherein his excellent performance with the fly is not given sufficient prominence to. All that is said is, "I am told that they, as well as *Elops saurus,* have been caught in the Madras Fort ditch with a white fly."

It is to be hoped that a sufficient case has been made out to induce sportsmen to "stock" fresh-water tanks anywhere near the coast with *Megalops.* The process is *not* very troublesome, and it *is* both interesting and productive.

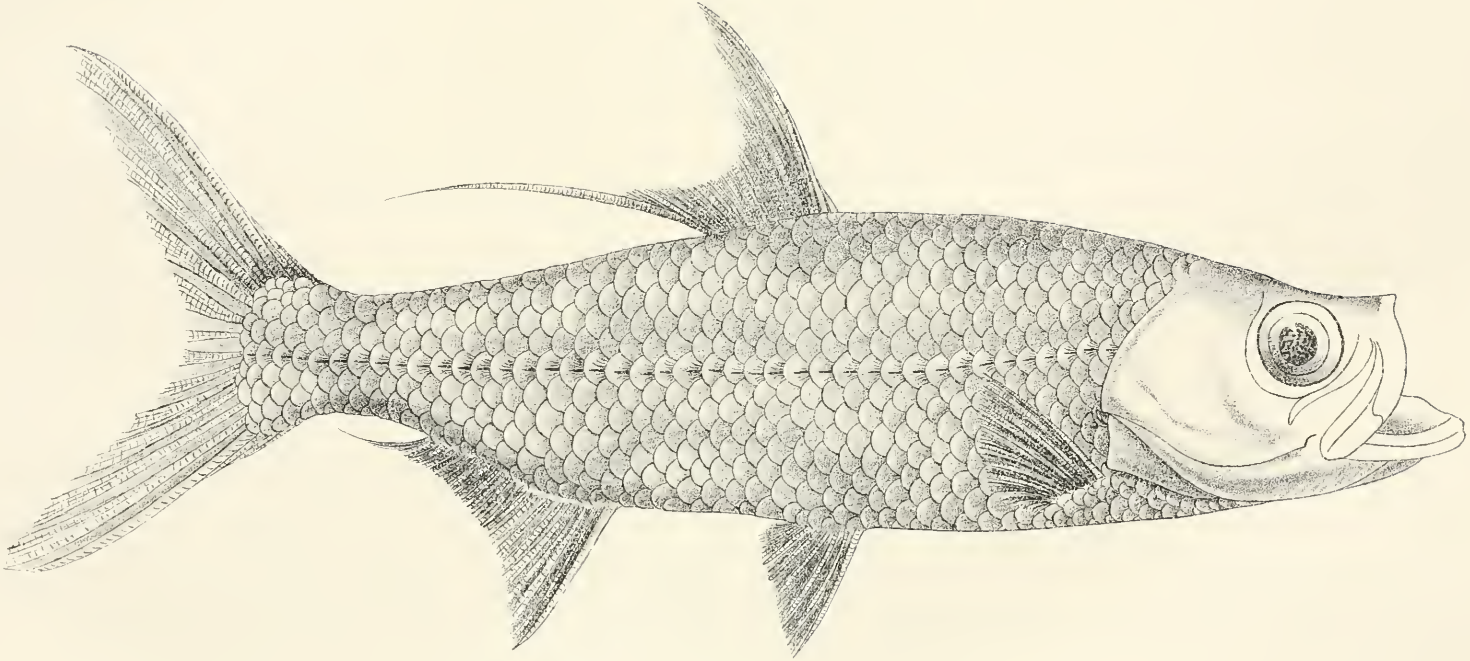
Locally, the fish is said to attain to a length of nearly 2 feet, at which stage he probably weighs between 3½ and 4½ lbs. A good fly-taker of this calibre deserves a very respectful consideration at all hands.

W. A. WALLINGER.

Order. PHYSOSTOMI

Megalops cyprinoides B xxiv—xxvi D. 19—21 ($\frac{2}{17-19}$)
V. 10 A 24—27 ($\frac{2}{25-52}$) C. 19 L.L. 37—42 L. $\frac{1}{12}$. 5—6/6
Vernacular name "Waras" (Marathi.)

ALIBAG, *19th April,* 1904.



No. XX.—THE LARGE BROWN FLYING-SQUIRREL (*PTEROMYS ORAL*).

I have just shot an old male specimen of this animal in the Partabgarh jungles, on the banks of the Kermoi stream, an affluent of the Jakam river, near the Bhil village of Ranna.* The spot is about 1,500 feet above sea level. The local people call it a cat with wings (Pank-wala Billi). They say that it is generally only seen at night. This one had been wounded in one hind leg, probably by some predatory animal, and came fluttering down close to our tents at about 8 o'clock in the morning, and then climbed half way up a tree before he could be secured.

Measurements :—

Length, including tail	2′-9″
Length, without tail	1′-3″
Greatest width stretched out...	2′-0″
Width between fore-feet	1′-8″
Width between hind-feet	1′-8″

Though I know these jungles well, I have never before seen or even heard of their being inhabited by this species or any kind of tree-squirrel.

A. F. PINHEY, Major,
Resident, Meywar.

Camp Ranna (Partabgarh),
14*th April*, 1904.

No. XXI.—INDIAN YAMS (*DIOSCOREA DÆMONA*), ROXB.

Mr. Hooper, under date 15th ultimo, writes in reference to the chemical analysis of *Dioscorea dæmona* which was quoted in my note at page 366 of the present volume of this Journal :—

" It is not quite fair to quote an analysis of a tuber containing 65 per cent. of water and compare it with the analysis of one containing 78·3 per cent. I have examined a few samples of yams from your district, and I am analysing the results calculated on the absolutely dry root. In doing this with the two specimens you quote we get—

	Yam.	Potato.
Fat	1·23	·46
Protein	8·91	10·14
Carbohydrates	78·94	84·79
Fibre	4·06	
Ash	6·86	4·61
	100·	100·

Where there is not such a wide difference in the protein and carbohydrates as is shown in the moist root."

---

* Latitude, 24° 12′.
Longitude, 74° 33′.

You say that your analysis of the yam is 'a general average.' Those I have examined have been one or two tubers of a distinct species, and I find the average nitrogenous matter of some thirty specimens to be higher than the potato. These results will shortly be published in an Agricultural Ledger."

In saying that the analysis of the yam was "a general average," it ought to have been made clearer that this remark alluded to the analysis of the potato recorded immediately above and not to *Dioscorea dæmona*.

I need scarcely say I am very much indebted to Mr. Hooper for giving me an opportunity of amending my note and also for sending me his interesting comparative analysis of the dry root of *Dioscorea dæmona* and potato.

The results of his examination of these various yams, which are to appear in an Agricultural Ledger, will be awaited with interest.

G. M. RYAN, I.F.S.

THANA DISTRICT, 11*th April*, 1904.

No. XXII.—SHOOTING NOTES IN CANNANORE.

I append a list of the game birds that have fallen to my gun this season around Cannanore. The backwater here with its many winding waterways opening out into jheellike expanses every here and there, and bordered with lowlying marsh land, appears at first sight to offer peculiar attractions to wild fowl, and it is therefore remarkable that practically none visit us. The whole system is tidal, and many of the water courses run empty with the ebb tides. Owing to these conditions, the water is brackish, and water weeds receive little encouragement to flourish, and it is possibly to both of these causes that one may attribute the paucity of species and numbers. During the whole season I have seen less than a dozen duck, and all I saw appeared to be of one species—whistling teal, I am told—but I got no chance of substantiating this information. The season is admitted by all, including our one and only local shikari, to have been an indifferent one, snipe being not nearly so plentiful as usual.

Snipe.	NOV.		DECEMBER.					JANUARY.											FEBRUARY.						TOTAL.
	8	29	17	19	25	26	31	3	6	11	12	14	17	19	21	24	28	31	4	7	11	21	25	27	
Gallinago cœlestis (Fantail)	3	1	..	4	7	1	..	4	..	..	2	..	4	..	2	..	10	7	1	8	..	11	1	7	73
Gallinago stenura (Pintail)	15	9	15	21	20	5	7	8	9	1	14	25	27	1	34	29	11	17	1	24	20	19	14	8	354
Rostratula capensis (Painter) ..	..	..	1	1	..	2	1	..	..	1	2	6	5	1	5	1	4	..	2	..	..	..	..	..	32
Others*	..	..	..	..	2	1	..	..	..	..	..	..	..	..	1	..	1	1	..	..	..	..	..	..	6
Bag	18	10	16	26	29	9	8	12	9	2	18	31	35	2	42	30	26	25	4	32	20	30	15	15	465

* These included 3 *Columba intermedia* (The Indian Blue Rock), 2 *Totanus glottis* (Greenshank) and 1 *Gallinago gallinala* (Jacksnipe).

F. WALL, CAPT., I.M.S.

CANNANORE, 20*th April*, 1904.

No. XXIII.—THE LAPWING OR PEEWIT (*VANELLUS VULGARIS*).

I see in Blandford that the Peewit has not been recorded further east than Oudh; it may be interesting therefore to note, that last cold weather it was fairly plentiful along the banks of the Upper Chindwin and in swampy ground in the same locality. To make certain one was shot on the 12th December 1903 and skinned for identification.

H. H. HARINGTON, CAPTAIN.

MONYWA, 17*th April*, 1904.

No. XXIV.—MELANISM AMONGST PANTHERS.

I do not know if the information is of any value beyond being corroborative, but on 20th March, some forest employés working in the forests near Hopin in the Bhamo District of Upper Burma came upon a black female leopard with cubs in a large hollow tree. They returned to camp and came out with an elephant, which scared the mother leopard and she bolted. The men were then able to secure the cubs, one of which was black, while the other was the ordinary spotted yellow kind. The latter died, but the black one is alive and doing well, and I propose to take him home next month for the London Zoo. This seems to make it perfectly clear that the black leopard is only a freak.

The cub I now have has a number of solitary white hairs all over the body and legs, and the whiskers are pure white. In certain lights the ordinary leopard spots can be distinctly seen, being jet black on a muddy black fur. I hope to watch the development of colour.

T. A. HAUXWELL,
Conservator of Forests.

MAYMYO, BURMA, 21*st April*, 1904.

No. XXV.—PAPILIO MACHAON IN BALUCHISTAN.

I saw, a few days ago, on a hill about midway between Quetta and Nushki, a fine Papilio, which I am certain was *machaon*. It was a perfectly fresh specimen, but seemed to be of a more greenish tint than those I have seen in England and the Himalayas. I watched it for some time, and almost succeeded in capturing it with my fingers. I do not know whether this species has previously been recorded from Baluchistan, but I have been over two years in the neighbourhood of Quetta, and never before saw any Papilio here, so perhaps it may be worth recording.

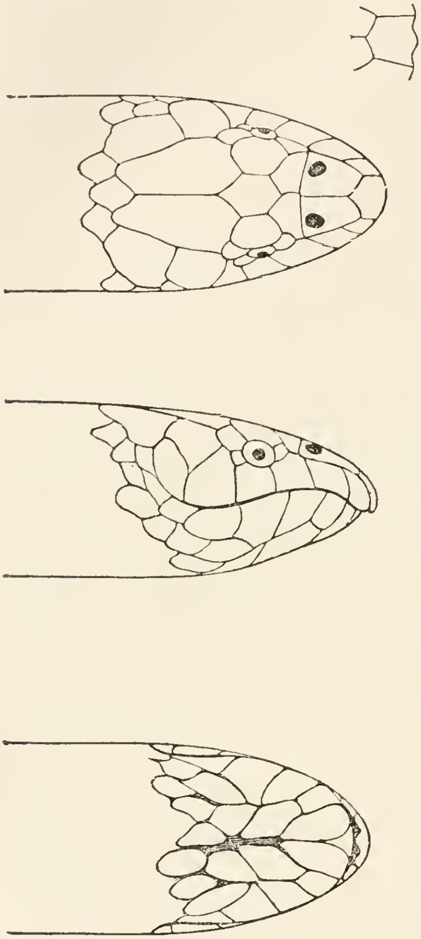
C. G. NURSE, MAJOR,
113th Infantry.

QUETTA, *May*, 1904.

No. XXVI.—OCCURRENCE OF A RARE SEA SNAKE (*DISTIRA GILLESPIÆ*) ON THE MALABAR COAST.

In the Bombay Natural History Society's Journal Vol. XII, page 642, Mr. G. A. Boulenger described and figured a new sea snake caught in the

Kurrachee harbour which he called *Distira Gillespiæ.*



Distira Gillespiæ.

On the 5th March this year I had a specimen of this evidently rare snake brought me by a fisherman I employ to collect for me in Cannanore. When questioned he doubted whether he had ever seen a similar snake before. My specimen almost exactly accords with Mr. Boulenger's description, and plate, but as the snake is so rare, and there appear to me some additional points worthy of mention, perhaps a repetition of the characters on my own lines may be of interest.

The snake, a male, measures 4 feet $2\frac{3}{4}$ inches, of which the tail accounts for $4\frac{5}{8}$ inches. It was brought alive and unscathed in a chatty, and proved to be remarkably active and strong, freeing itself repeatedly from the grasp of my long metal tongs. Removed from its native element the forepart of the body is freely and actively mobile, but progression is almost nullified by the weight and conformation of its hinder parts.

General Characters.—The head is of the same calibre as the anterior part of the body. The snout projects well over the chin. The eye is small, situated laterally, with a slight inclination upwards, and the iris during life was too dark to permit of the shape of the pupil being investigated. After immersion in spirit the pupil is seen to be round. The commissure of the mouth is peculiar viewed in profile, resembling an italic *f* with the curves exaggerated, and the anterior convex upwards. The neck shows no constriction behind the head. The body is cylindrical and of nearly uniform calibre in about its anterior half, when it rapidly increases, acquiring a markedly compressed character and heavy form, the depth of the snake at its greatest girth being about four times that in its anterior part. The tail as in other hydrophides is markedly flattened from side to side (compressed).

Color.—Head blackish above, merging to yellowish laterally. Chin (except at tip which is blackish) and throat yellowish. Body anteriorly lemon-yellow with black dorsal rhomboids confluent by their angles vertebrally. Black similarly shaped marks on belly, confluent by their angles, form a ventral streak. Posteriorly olive greenish black dorsally with obscure transverse darker bars, merging to pale lemon in the flanks. The ventral black line is continued to vent and after this is most conspicuous at the lower border and tip of tail. Anteriorly the colors are bright, and glistening; posteriorly pale, and dull.

Scale Characters. Rostral.—Height in median line very slightly exceeds the breadth. Lower border with central lobulus as in other sea snakes in contact with 4 shields, of which the 1st supralabial sutures are rather larger than the nasal.

Nasals.—Large, contiguous, in contact with the 1st and 2nd supralabials, (and 3rd also on right side). Length 3 times the suture between the præfrontals. Nostrils situated in postero-external part of shield with no suture running to shield margin.

Præfrontals.—Small. In contact with nasal, præocular, supraocular, and frontal (and 3rd supralabial on right side).

Frontal.—Small. Length less than distance to rostral; subequal to supraoculars; rather greater than half the parietals. Breadth. Subequal to supraocular. In contact with 6 shields, of which the parietal sutures are longest, and the præfrontal smallest.

Parietals.—Rather narrow. *Supralabials* 7. All well developed; the 3rd and 4th touching the eye; 5th largest.

Præoculars.—One; smaller than the eye.

Postoculars.—Two; the lower very small.

Temporals.—One, large, in contact with the 5th and 6th supralabials, and succeeded by a rather larger shield touching the parietals.

Sublinguals.—Two well developed, subequal pairs, the fellows of each in contact with one another.

Infralabials.—6. Well developed, the first 4 touch the sublinguals. The first are large, in contact with one another forming a suture larger than that between the anterior sublingual fellows. The 4th is the largest of the series and constitutes the pentagonal; it is fully once and a third as broad as the posterior sublinguals, and is in contact with two scales behind.

Scales.—Anterior (*i.e.*, two heads lengths behind the head) 21 rows, glossy, smooth, and very distinctly imbricate, about as long as broad, subequal, or those of last row very slightly largest. Midbody (not including tail) 35-37 rows, not glossy, hexagonal, juxtaposed, bi or trituberculate, those of lowest rows plurituberculate, and larger than those of vertebral rows. Posterior (*i.e.*, two heads lengths in front of vent) 35-39 rows, with characters as in midbody.

Supracaudals.—Midtail 14 on each side, with 1 above and 1 below. A shield at tip of tail about twice the size of adjacent scales.

Ventrals 377. Anterior, well developed, smooth, entire, and nearly twice the breadth of adjacent rows. Midbody—Bi and trituberculate; many divided. Posterior—Bi and trituberculately, mostly divided. *Anal* 7 fid, small.

F. WALL, C.M.Z.S.,
Captain, I.M.S.

CANNANORE, 1*st May*, 1904.

No. XXVII.—THE EGGS OF THE SMALL SUN-BIRD (*ARACHNECTHRA MINIMA*).

In the last number of the Society's Journal, page 473, there is a most interesting article on the birds of Travancore, by Mr. H. S. Fergusson. In it I notice he refers to Mr. Bourdillon's notes as to the eggs of *Arachnecthra minima* being minateurs of those of *Arach. asiatica.*

Now this has been stated before in Oates's "Nests and Eggs" with regard to nests taken on the Nilgherries. I wish Mr. Fergusson had mentioned if he had personally ever come across such eggs, as it is evident either a mistake having been once made about this bird it is again and again repeated, or that the bird lays in different places totally different eggs. In Kanara and about Matheran near Bombay the bird is very common, but breeds early in the year, generally in December and January, and I must have examined forty or fifty of their nests. In no one of these could the eggs or nests have been mistaken for either *zeylonica* or *asiatica.*

The nests of *minima* I have always found made of bright green moss ornamented with broad bands of white material, suspended in nine cases out of ten at about three feet from the ground on the edge of a plant of *Strobilanthus.* They were much smaller than the brown fibre-built nests of the two larger honey-suckers.

The eggs, of which I must have seen fifty, were all similar. They were considerably smaller, and more blunt than *asiatica,* and instead of being greenish-white, thickly spotted with greenish-brown, were clear white, minutely spotted, on the larger end with purple, forming a well-defined zone round the larger end. I hope Mr. Bourdillon if still in Travancore, or Mr Fergusson, will be able to clear up the matter.

J. DAVIDSON.

EDINBURGH, 25*th April* 1904.

No. XXVIII.—OCCURRENCE OF THE CEYLON WHITE-EYE (*ZOSTEROPS CEYLONENSIS*) IN THE NILGHERRIES.

It may be worth recording that on the 5th June 1903 I shot a specimen of the Ceylon White-Eye (*Zosterops Ceylonensis*) at Coonoor, in the Nilgherries, and that several birds, of this species, were observed by me at the time.

D. G. HATCHWELL.

MADRAS, 15*th May*, 1904.

No. XXIX.—OCCURRENCE OF THE WHITE-THROATED ROCK-THRUSH, *PETROPHILA (MONTICOLA) GULARIS*, IN BURMA.

Among some birds' skins which I took home for the British Museum at South Kensington was one which was identified by the authorities there as *Petrophila gularis.* I shot the bird in Popa during April 1903 and as this species has hitherto not been included in the Fauna of British India, its occurrence is worth recording.

K. C. MACDONALD,
D. S., Police.

PAKOKKU, Upper Burma, *May*, 1904.

No. XXX.—THE INDIAN EDIBLE-NEST SWIFTLET (*COLLOCALIA FUCIPHAGA*) IN THE PULNEY HILLS.

I was rowing about on the lake at Kodaikanal, Pulney Hills, a few days ago, just before a heavy storm, and could not help noticing a large number of Swifts skimming over the surface and plunging into the water, after some insect, frequently from a height of 10 or 15 feet. There must have been many hundreds and they seemed all to belong to the same species (*Collocalia fuciphaga*). Their speed was too great to allow me to see clearly whether they actually plunged below the surface. I think not, but the violence with which they struck the water was surprising and caused it to splash up 18in. or 2ft. While I was wondering if by any chance one ever fell in and was unable to rise again, I saw one dash in, as if in answer to my thoughts, and after several attempts to get out it lay there flapping about helplessly. I rowed up to it as quickly as I could and reached it just as it was apparently dying. However I fished it out of the water which was very cold, and after thoroughly drying its plumage and warming it, which occupied me for about an hour, I opened my hands and away it flew, apparently little the worse for its unpleasant experience. I have dozens of times watched these birds hawking insects over water, but, though one would think such an accident must happen frequently, I have never before actually seen it occur.

This Swift, I may add, (which builds the common Indian edible nest) breeds regularly on the Pulneys, one of its favourite haunts being the caves and sides of the famous Pillar Rocks.

R. FOULKES.

VIZIANAGRAM, 17*th May*, 1904.

No. XXXI.—THE BOLDNESS OF PANTHERS.

A short time ago I was camping at the village of B. J. near M., in Central India, when *khabar* was brought to me of two panthers which had killed and eaten a young buffalo belonging to another village about three miles away; so I determined to try and shoot one of them at least. I at once bought two goats and tied them up and sat over one in a *machhaan;* they were both placed in nalas not far from the village, but nothing came near my goat the whole night and I heard no sounds of anything ; but in the morning my native *shikari* told me that the other goat had been killed about 4 a.m., and that one hind leg had been eaten ; so the next night I sat over this kill, and had the other goat taken back to the village.

The kill was lying in the dry stony bed of a stream which at this spot had low banks ; there were a few big boulders about, but these were not in the way for shooting. About twenty yards away there was a very small pool of water, but this was just out of sight of the *machhaan*, which was placed about 20 yards from the goat in a tree about 15 feet from the ground.

I got into the *machhaan* at 5-15, but nothing appeared, except mongoose and birds to drink, till 8-30, when a panther suddenly rushed up the nala, making a good deal of noise and seized the goat by the remaining hind leg and tried to drag it off, but it was firmly tied to a bush stump. He then rushed away to the pool to drink, and at 8-40 p.m. again returned to the kill. It was then only just light enough to see the panther, as the moon had not risen. I had two shots and missed both barrels, the panther going away to my right in some thin bushy jungle broken up with small nalas.

At 9-45 p.m. I heard a panther growl almost directly underneath where I was sitting, but I could not see it, as the *machhaan* and tree were in the way.

At 11-20 a second panther came and I again missed with both barrels ; this panther was only a half-grown cub judging from its size; as it was very small indeed. It went away to the right front into the same piece of jungle as the first panther had gone.

From midnight till 1-15 a.m. there was continuous growling about 30 to 50 yards away to the right front, where the two panthers had gone. At 1-20 a.m. a third panther came to the goat and began to eat, and this time I wounded it slightly, as in the morning we discovered a few drops of blood about 20 yards from the goat in the direction where it had gone, to the left front, but the ground was too hard for tracking, and we never found it.

At 3-40 a.m. a fourth panther started eating, but this time I had better luck and shot it dead first shot, the bullet entering the right side of the nose and breaking away two inches of the lower left jaw bone; he evidently died practically at once, as I never saw or heard him move again and we found him with his head lying in the middle of the goat's body.

At 4-3 a.m. there was a good deal of growling close to the goat but inside the line of bushes, and I could see nothing; but at 4-7 a.m. I saw a panther walking round the goat in a circle of about 5 yards radius, looking at the dead panther (a male—this one, the fifth, was a female). This time again I killed it first shot, the bullet breaking the back-bone, and I found her in the morning in the exact place where she was when I fired ; she answered the shot with a deep growl, but I never saw or heard her move again, and she must have also died almost at once.

At 4-30 a.m. the moon went behind a big hill and it got very dark ; however nothing more came and at 5-30 a m. I got down and inspected the results.

The following are the measurements I took almost immediately afterwards:—

	1st, male.	2nd, female.
	Inches.	Inches.
Length from tip of nose to tip of tail, straight ...	78	68
,, following the curves of back, &c.	83	70
Length of tail	29¾	27¼
,, ,, head from tip of nose to tip of nape...	11½	9
Girth of upper forearm	10	7¾
,, ,, body	32½	25½
Height at shoulder, standing position	26	22½
,, ,, paw stretched out	29	24¾
Length of hind leg from stifle joint to tip of paw...	10	8¾

You will notice that in the male the girth of the forearm and length of hind leg are the same, 10″; but in the female the girth of the forearm is one inch less than the length of the hind leg.

The next night I sat up again over the same kill, but as this was my third night up I was very sleepy indeed. I had been unable to sleep during the day on account of the heat; consequently at 9-30 p.m. I fell asleep and did not wake till exactly midnight. I then discovered the second hind leg of the goat had been eaten and that it had also been moved about 4 yards; I managed to keep awake after this, and at 12-58 a panther came and started to eat, but I missed both barrels, and he never came again, and at 5-45 a.m. I got down from the *machhaan.*

This, I think, accounts for five panthers at one kill in one night.

There were the two I shot; and the half-grown cub and the wounded one (4) which cannot have been either of those I shot later, as both of them had only one wound; also there was the one that came first of all at 8-3 p.m. Now this may possibly have been the one I wounded later, or one of those I shot, but if either of these be the case, how can the one that came the second night be accounted, as it was much too big to be the half-grown cub? If it had anything to do with the killing of the goat it would in all probability have come the first night, or else it shows that panthers will eat carrion. It may possibly have been the wounded one, but as it was only evidently slightly wounded it would be quite able to kill food for itself. On the second night it did not appear to have anything the matter with it, and did not walk at all lame. Of course it is well known that panthers will return to a kill after having been shot at from a *machhaan*, but I did not know that a wounded beast would do so.

M. YOUNG,
York and Lancashire Regiment.

MHOW (C. I.), *May* 1904.

No. XXXII.—A VIPERINE SNAKE WHICH IS OVIPAROUS.

I believe it is generally accepted that the Vipers are viviparous. Now I have had sent to me by Father Bertrand, of the Theological Seminary at Kurseeong, a cluster of some 10 eggs, from 2 of which the young ones issued forth while he and some other Fathers were examining them. On examining them I found them to belong to the *Crotalinæ*—they being 2 *Trimeresurus monticola*. They are about 6 inches long, pale yellow, and show the full markings of the grown-up specimens but slightly paler ; the head scales as well as those of the body are fully developed. In the other eggs you can make out the outlines of the young snakes quite clearly. I shall be glad to send you one of the two young snakes with the shell or rather skin of the egg from which it came forth, as also an egg containing a young one if you wish it.

G. A. MILLER.

St. Joseph's College, Darjeeling,
10*th May* 1904.

The specimens above referred to have arrived, and as Mr. Miller is perfectly correct in his identification we now possess the important evidence that this Viperine Snake (*Trimeresurus monticola*), or as it is now called *Lachesis monticola*, is oviparous.

EDITORS.

PROCEEDINGS

OF THE MEETING HELD ON 21st JANUARY 1904.

A meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 21st January 1904, Dr. A. H. Deane presiding.

The Honorary Secretary stated that His Excellency Lord Lamington, the Governor of Bombay, had kindly agreed to become President of the Society.

NEW MEMBERS.

The election of the following new members was announced :—Mr. C. E. Scovell, C.E. (Loilem, S. Shan States, Burma) ; Captain B. F. R. Holbrooke (Poona) ; Mr. Philip Tinne, I.F.S. (Darjeeling) ; Mr. R. F. Stoney (Madura, S. I.) ; Captain T. E. Watson, I.M.S. (Madura, S. I.) ; Mr. A. W. Hardy (Talup, Assam) ; Mr. Coleridge Beadon, F.G.S. (Oorgaum, S. I.) ; Lieutenant H. S. Perrot, R.G.A. (Camp Dthali, Aden Field Force, S. Arabia) ; Colonel C. G. F. Fagan, I.A. (Alwar, Rajputana) ; Captain H. A. F. Margarth (Fort Lockhart) ; Mr. W. G. Page (Surat) ; Mr. J. T. O. Barnard (Kamaing, Upper Burma) ; H. H. the Maharajah Tukuji Rao Holkar (Indore, C. I.) (Life Member) ; Mr. F. Fletcher (Poona) ; Mr. W. McC. Kirkpatrick (Delhi) ; The Secretary, Kasauli Club (Kasauli, Punjab) ; Mr. T. N. C. Nevill (Bramall Hall, near Stockport, Cheshire) ; The Mess President, 130th Baluchis (Hyderabad, Sind) ; Captain C. C. Cobbe (Waltair) ; Lieutenant H. J. Elles, R.E. (Roorkie) ; Lieutenant Chas. Elliot (Rangoon) ; Mr. C. J. Mackay (Mozufferpore, T. S. R.) ; Mr. A. Parasu Ramdas Patro, B.A. (Berhampore) ; Rev. E. Blatter, S.J. (Bombay) ; The Vice-President, Natural History Museum (Darjeeling) ; and Captain J. T. Campbell (Simla).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. H. M. Phipson, acknowledged receipt of the following contributions since last meeting :—

Contribution.	Description.	Contributor.
1 Demoiselle Crane............	*Anthropoides virgo*	Mr. R. H. Heath, C.E.
7 Large or Black-bellied Sand Grouse (Imperial Sand Grouse).	*Pterocles arenarius*...........	Do.
1 Stone-Curlew	*Œdicnemus scolopax*	Mr. J. Brand.
1 Night Heron.................	*Nycticorax griseus*............	Mr. C. Nopper.
Some photographs of Flamingoe's nests in the Runn of Cutch.	... ..	H. H. The Rao Saheb of Cutch.
6 Eggs of Flamingo from the Runn of Cutch.	......	Do.
A number of Moths............	......	Mr. T. R. D. Bell, I.F.S.
Nest and Egg of the Spotted Grey Creeper.	*Salpornis spilonota*	Do.
Specimens showing the development of the Trout.	......	Mr. Midgley Taylor, C.E.
Photographs of Tropic Bird.	*Phaeton indicus*	Mr. W. D. Cumming.
1 White-winged Wood Duck	*Asarcornis scutulatus*........	Mr. W. O. Hannyngton.

Contribution.	Description.	Contributor.
1 Tufted Duck	*Myreca fuligula*	Mr. C. H. Donald.
2 Persian House Mice	*Mus bactrianus*	Col. A. E. Ward.
1 Brown Musk Shrew	*Crocidura murina*	Do.
1 White-nosed Weasel	*Putorius canigula*	Do.
1 New Rat	*Mus vicerex sp. n*	Do.
1 Houbara	*Houbara macqueeni*	Mr. R. H. Brooke.
1 Bronze-winged Dove (alive).	*Chalcophaps indica*	Mr. C. M. Sherman (Calicut).
1 Slender Loris	*Loris gracilis*	Mr. W. Copleston, I.F.S.
1 Slaty-backed Forktail	*Henicurus schistaceus*	Mr. S. L. Whymper.
1 Green Tree Snake	*Dryophis mycterisans*	Mr. F. J. Rome.
A number of Butterflies from Poona.	......	Mrs. Thomson.
1 Python (alive)	*Python molurus*	Mr. T. J. Spooner, C.E.
1 Siberian Viper (from Bagdad).	......	Capt. W. H. Cox, I.M.S.
1 Small Indian Civet (alive)	*Viverricula malaccensis*	Mr. J. M. Lobo.

Minor contributions from Mr. C. V. Vernon, I.C.S., Dr. E. Wells-Witham and H. H. the Rao Saheb of Cutch.

The following contributions to the Library have been made :—Rivista critica del Genere Gossypium, pel Dottor Angelo Aliotta, from the Author ; and The Geography of Mammals by Dr. W. L. Sclater and P. L. Sclater, from the Authors.

The following papers were then read and discussed :—

1. The popular names of some plants, by E. Comber, F.Z.S.
2. Abnormal growth of trees by C. E. C. Fischer, I.F.S.
3. Some notes on Harrier Hawks in Uva, Ceylon, by F. Sikes.
4. The Batrachians of Travancore, by H. S. Ferguson, F.L.S.
5. Some notes on various insects, by L. C. H. Young.
6. The colouration of birds' eggs, by D. Dewar, I.C.S.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 25TH FEBRUARY 1904.

A meeting of the members took place at the Society's rooms on Thursday, the 25th February 1904, the Rev. E. Blatter, S.J., presiding.

NEW MEMBERS.

The election of the following new members since the last meeting was duly announced :—Major H. D. Merewether (Jhalawad Prant, Guzerat) ; Mr. W. G. Wooster (Yawng Hwe, S. Shan States) ; Mr. S. M. Douglas, B.A. (Mandalay) ; Mr. H. R. Rylands (Manekpur, Bassein Road) ; Mr. Shivram V. Bhandarkar B.A., LL.B. (Bombay); Major A. R. Knox, R.F.A. (Barrackpore); Mr. E. Staples, C.E. (Dum Dum); Captain E. C. MacLeod, I.M.S. (Aijal, Lushai Hills, Assam) ; Mr. F. Napier (Karachi Canals, Sind) ; Captain F. D. S. Fayrer, I.M.S. (Madras); Mr. G. E. Lodge (London) ; Mr. R. A. Lyall (Rajputana) ; Lieutenant-Colonel P. Schletter, C.B. (Rangoon); Mr. H. H. F. M. Tyler'

I.C.S. (Chittoor, N. Arcot District); The Principal, Medical College (Madras); Mr. A. W. Ogilvie, S.F.S. (Chiengmai, Siam); Mr. H. B. G. Garrett, S.F.S., (Chiengmai, Siam); The President, High Range Natural History Society (Aneimudi, Munaar, P. O., S. India); Mr. H. P. LeMesurier, C.E. (Calcutta).

CONTRIBUTIONS TO THE LIBRARY.

The Honorary Secretary, Mr. H. M. Phipson, acknowledged receipt of the following contributions since last meeting :—

Contribution.	Description.	Contributor.
A number of Butterflies ...	......	Mr. C. E. C. Fischer, I.F.S.
A collection of Spiders, &c.	......	Do.
1 Common Hawk Cuckoo (alive).	*Hierccoccyx varius* ...	Mrs. A. P. Brewin.
1 Malayan Wreathed Hornbill.	*Rhytidoceros undulatus* ...	Mr. L. O. Clarke.
1 Rufous-necked Hornbill.	*Aceros nepalensis*	Do.
1 Adjutant	*Leptoptilus dubius*... ...	Do.
1 Large Malay Squirrel ...	*Sciurus bicolor*	Do.
1 Nest and Young of Painted Snipe.	*Rostratula capensis* ...	Mr. S. Lightfoot.
A collection of Indian Stone Implements.	......	Mr. H. W. Seton-Karr.
1 Snow Leopard (alive), (deposited).	*Felis uncia*	Capt. J. B. Mackintosh, R. A.
1 Tickell's Blue-Flycatcher.	*Cyornis tickelli*	Mr. Sunderrao D Navalkar
3 Sandas (alive)	*Uromastix hardwickii* ...	Mr. C. M. Sykes.
5 Indian Desert Gerbills (alive).	*Gerbillus hurrianæ* ...	Do.
1 Sheldrake...	*Tadorna cornuta*	Major A. E Hatch.
A number of Vegetable Caterpillars.	......	Sir Donald Robertson.
1 Snake (alive)	*Dipsus trigonata*	Mr. C. Beadon.
1 Snake (alive)	*Zamenis fasciolatus* ...	Do.

CONTRIBUTIONS TO THE LIBRARY.

Rivista critica del Genere Gossypium, pel Dottor Angelo Aliotta, from the Author.

The Geography of Mammals by Dr. W. L. Sclater and P. L. Sclater.

Two copies of the Birds of Cutch, by Captain C. D. Lester, from H. H. the Rao of Cutch.

The Mighty Mahseer and other Fish, or Hints to Beginners on Indian Fishing by Skene Dhu, from the Author.

Memoir of the Geological Survey of India, Himalayan Fossils, Vol. I., Part 5, in exchange.

Bulletin de la Societe Royale de Botanique de Belgique, Vol. 40.

Notices sur les Plantes utiles, ou interessantes, de la Flore du Congo, par Emile de Wildeman.

Faune Entomologique de L'Afrique tropicale (Longicornes) par Aug. Lameere, from the Author.

THE ACCOUNTS FOR 1903.

Mr. N. C. Macleod, the Honorary Treasurer, placed before the meeting a statement of accounts for the year ending 31st December 1903, showing:—Balance brought forward Rs. 1,562-5-2, income during 1903, Rs. 15,379,-8-4 = Rs. 16,941-13-6—expenditure during 1903 = Rs. 13,828-0-7; balance carried forward Rs. 3,113-12-11. One hundred and fifty new members were elected during the year, and the sale of back numbers of the journal realized Rs. 1,935. The accounts were approved of, subject to the usual audit, and a vote of thanks was passed to Mr. N. C. Macleod, the Honorary Treasurer.

ELECTION OF OFFICE-BEARERS FOR 1904.

The following members were elected for the present year:—President—H. E. Lord Lamington. Vice-Presidents—Mr. J. D. Inverarity, Rev. F. Dreckmann, S.J., and Mr. E. H. Aitken. Managing Committee—Vety.-Major G. H. Evans, Mr. E. C. Stuart Baker, F.Z.S., Mr. E. H. Aitken, Rev. F. Dreckmann, S.J. Mr. E. Ernest Green, F.E.S., Lieutenant-Colonel K. R. Kirtiker, I.M.S., Mr. J. D. Inverarity, B.A., LL.B., Lieutenant-Colonel H. D Olivier, R.E., F.Z.S.. Mr. A. Abercrombie, Mr. E. L. Barton, Mr. E. Comber, F.Z.S., Mr. T. R. D. Bell, I.F.S., Major A. Newnham, F.Z.S., Major C. G. Nurse, F.E.S., Mr. L. C. H. Young, and Mr. G. C. Dudgeon. Mr. N. C. Macleod, Honorary Treasurer (*ex-officio*), and Mr. H. M. Phipson and Mr. W. S. Millard, Honorary Secretaries (*ex-officio*).

PAPERS READ.

The following papers were then read and discussed:—1. Distribution of Butterflies in the Indian Area, by L. C. H. Young, B.A. 2. Further Notes on some of the Plants introduced into the Victoria Gardens, Bombay, during the past eight years, by C. D. Mahaluxmivala.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 31st MARCH 1904.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on Thursday, the 31st March 1904, Rev. F. Dreckmann, S.J., presiding.

NEW MEMBERS.

The election of the following new members since the last meeting was duly announced:—

Mr. W. Maxwell (Assam); Dr. K. Lloyd Patterson (Assam); Mr. J. Crerar, I.C.S. (Larkana, Sind); Mr. R. H. Lushington (Vizianagram); Captain C. H. Turner (Mandalay); Captain C. F. G. Lang (Madras); Lieut. A. G. M. Cole (Bombay); Major G. F. Mockler (Umballa); Captain A. W. Hasted (Kasauli); Lieut. A. J. V. Betts, I.M.S. (Hyderabad, Sind); Mr. Morton Eden (Assam); The Curator, Victoria Museum (Karachi); Lieut. M. Young (Mhow), and Dr. F. A. Meyer (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's collections:—

Contribution.	Description.	Contributor.
1 Tickell's Flower Pecker....	*Dicæum erythrorhyncus*......	Mr. G. M. Ryan, I.F.S.
1 Panther (alive)...............	*Felis pardus*.......................	Capt. R. H. Metge.
1 Eel (alive).......................	*Muræna undulata*	Mr. E. H. Young, C.E.
1 Whooper Swan................	*Cygnus Musicus*..................	Mr. J. Crerar, I.C.S.
1 Avocet............................	*Recurvirostra avocetta*........	Mr. J. Wallace, C.E.
1 Snake (alive)...................	*Acrochordus javanicus*....	The Hon. R. A. Forbes-Sempill.
1 Crested Hawk Eagle.......	*Spizaetus cirrhatus*............	Mr. C. E. C. Fischer, I.F.S.
A number of Moths and other Insects.	......	Do.
Skull of a Bear................ .	*Melursus ursinus*................	Do.
2 Himalayan Nutcrackers....	*Nucifraga hemispila*...	General W. Osborn.
1 Black and Yellow Grosbeak.	*Hesperiphona icterioides*......	Do.
A number of Shells............	......	Mr. J. Watson.
1 Screech-Owl (alive).........	*Strix flammea*..	Mrs. Nelson.

CONTRIBUTIONS TO THE LIBRARY.

The Indian Field Shikar Book, by W. S. Burke, from the Author.

The Coccidæ of Ceylon, by E. Ernest Green, Part III, from the Author.

PAPERS READ.

The following papers were read and discussed:—1. On the Protective Colouration of Birds' Eggs, by H. P. W. Macnaghten, B.A. 2. Birds' Nesting in the Neighbourhood of Poona, by Major R. M. Betham. 3. The Nesting of the Hornbills and other Notes, by Lieut.-General W. Osborn. 4. Tiger *versus* Bear and other Notes, by Captain W. H. Lane. 5. The Food of the Common Krait, by Captain F. Wall, I.M.S. 6. Occurrence of the Whooper Swan in Sind, by J. Crerar, I.C.S.

EXHIBITS.

Mr. E. L. Barton exhibited a number of specimens of boars' heads, bears, chital, &c., which he had mounted, and a vote of thanks was passed to him for the work he had done for the Society during the last twenty years.

Bombay Natural History Society.

OFFICE-BEARERS, LIFE MEMBERS, HONORARY CORRESPONDING MEMBERS, AND MEMBERS *ON 30TH SEPTEMBER 1904.*

LIST OF OFFICE-BEARERS.

President.

H. E. the Right Honourable LORD LAMINGTON, G.C.M.G., G.C.I.E.

Vice-Presidents.

Mr. J. D. Inverarity, B.A., LL.B. | Rev. F. Dreckmann, S.J.
Mr. E. H. Aitken.

Hon. Secretaries.

Mr. H. M. Phipson, C.M.Z.S. | Mr. W. S. Millard.

Hon. Treasurer.

Mr. N. C. Macleod.

Editors.

Mr. H. M. Phipson, C.M.Z.S. | Mr. W. S. Millard.

Managing Committee.

Vet.-Major G. H. Evans.
Mr. E. C. Stuart Baker, F.Z.S.
Mr. E. H. Aitken.
Rev. F. Dreckmann, S.J.
Mr. E. Ernest Green, F.E.S.
Lt.-Col. K. R. Kirtikar, I.M.S.
Mr. J. D. Inverarity, B.A., LL.B.
Lt.-Col. H. D. Olivier, R.E., F.Z.S.
Mr. G. C. Dudgeon, F.E.S.
Mr. A. Abercrombie.
Mr. G. M. Ryan, I.F.S.
Col. W. B. Bannerman, I.M.S.
Mr. E. Comber, F.Z.S.
Mr. T. R. D. Bell, I.F.S.
Major A. Newnham, F.Z.S.
Major C. G. Nurse, F.E.S.
Mr. L. C. H. Young, B.A., F.E.S.
Mr. J. McNeill, I.C.S.

Mr. N. C. Macleod, *ex-officio.*
Mr. H. M. Phipson, C.M.Z.S., *ex-officio.*
Mr. W. S. Millard, *ex-officio.*

1st Section.—(*Mammals and Birds.*)
President—Mr. J. D. Inverarity, B.A., LL.B.
Secretary—Mr. E. Comber, F.Z.S.

2nd Section.—(*Reptiles and Fishes.*)
President—Rev. F. Dreckmann, S.J.
Secretary—Mr. H. M. Phipson, C.M.Z.S.

3rd Section.—(*Insects.*)
President—Mr. E. H. Aitken.
Secretary—Mr. L. C. H. Young, B.A., F.E.S.

4th Section.—(*Botany.*)
President—(*Vacant.*)
Secretary—Lt.-Col. K. R. Kirtikar, I.M.S., F.S.M. (France), M.R.C.S.

Bombay Natural History Society.

LIST OF MEMBERS.

Life Members.

Aga Khan, H.H. Aga Sultan Mahomed Shaha	Bombay.
Austria, H. I. H. the Archduke Franz Ferdinand	*Europe.*
Baker, E. C. Stuart (F.Z.S., M.B.O.U.)	Dibrugarh, Assam.
Baroda, H. H. the Maharaja Sir Sayaji Rao, Gaekwar of	Baroda.
Barton, E. L.	*Europe.*
Bates, S. B. (F.Z.S.)	Banmauk, Burma.
Beale, H. F.	Poona.
Bhownagar, H. H. Bhaosingji Takht Singji, the Maharaja of	Bhownagar.
Bhurie Singh, Mean Saheb (C.I.E.)	Chamba.
Bikaneer, H. H. Major Sir Gunga Singji, G.C.S.I., Maharaja of	Bikaneer.
Burder, H. C.	*Europe.*
Caccia, A. M. (I.F.S.)	DehraDun, N.-W.P.
Cama, Dr. Maneckji D.	Bombay.
Cama, K. R.	Bombay.
Campbell, Lt. D.	*Europe.*
Clarke, L. O.	Aijal, Assam.
Cooch-Behar, H. H. Sir Nripendra Narayen Bhup Bahadoor, G.C.I.E., Maharaja of	Cooch Behar.
Coode, J. M.	Jabalpur, C. P.
Cursetji, Khan Bahadoor C. M.	Bombay.
Cutch, H. H. Sir Shri Kengurji Sawai Bahadoor, G.C.I.E., Rao Saheb of	Cutch.
Dawson, W. H. (I.C.S.)	*Europe.*
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Drake-Brockman, Major H. E. (I.M.S.)	Bhurtpur.
Dwarkadas, Naranji	Bombay.
Foulkes, Capt. T. M. (I.M.S.)	Waltair, Madras.
Fulton, Capt. H. T.	Dehra Dun.
Gammie, Professor G. A.	Poona.
Goculdas, Nurrotum Morarji	Bombay.
Gwalior, H. H. Col. Sir Madho Rao Scindia, G.C.S.I., G.C.V.O., the Maharaja of	Gwalior, C. I.
Habibuddin, S. (N.C.S.)	Hanumkonda, Hyderabad, Deccan.
Hide, P.	Poona.

Holkar, H. H. the Maharaja Tukuji Rao	Indore.
Hyam, Judah	Poona.
Ichalkaranji, The Hon'ble Meherban Narayenrao Govind, *alias* Babasaheb Ghorpade, Chief of	Kolhapur.
Inglis, C. M.	Darbhanga.
Inverarity, J. D. (B.A., LL.B.)	Bombay.
Jamkhandi, Shrimant Parashram Ramchandra Patwardhan, The Chief of	Kolhapur.
Janjira, H. H. Sir Sidi Ahmed Khan, Nawab of	Janjira.
Kolhapur, H. H. Sir Shahu Chhatrapati The Maharaja of, G.C.S.I., G.C.V.O.	Kolhapur.
Kotah, H. H. Sir Umed Sing Bahadoor, K.C.S.I., the Maharaja of	Kotah.
Lamb, R. A. (I.C.S., C.I E.)	Poona.
Long, G. R. (I.F.S.)	Minbu, Burma.
MacDonald, Dr. D.	*Europe.*
Manders, Major N. (R.A.M.C.)	*Europe.*
Mandlik, Narayan Vishvanath	Bombay.
Marshall, Arch. McL.	*Europe.*
Marshall, J. McL.	*Europe.*
Martin, Lieut.-Col. Gerald	*Europe.*
Masani, A. M., Curator, Baroda State Museum	Baroda.
Mills, J. D.	*Europe.*
Miraj, Shrimant Gungadharrao Ganesh, *alias* Babasahib Patwardhan, Chief of	Miraj.
Muspratt, E.	Sibsagar, Assam.
Mysore, H.H. Krishna Raj Woodayar Bahadoor, the Maharaja of	Mysore.
Navanagar, H. H. Maharaja Shri Jaswat Singji, the Jam Sahib of	Rajkote.
Nurse, Major C. G. (F.E.S.)	Quetta.
Olivier, Lieut.-Col. H. D. (R.E., F.Z.S.)	Bombay.
Partridge, Henry	Pyinmana, Burma.
Pestonji Jivanji	Hyderabad, Deccan.
Petit, Bomanji Dinshaw	Bombay.
Petit, Dhunjibhoy Bomanji	Bombay.
Petit, Jehangir Bomanji	Bombay.
Phipson, H. M. (C.M.Z.S.)	Bombay.
Poncins, Baron Edmond de	*Europe.*

Ravenshaw, Lieut.-Col. C. W.	Nepal.
Roberts, Capt. M. B.	Lansdowne.
Seton-Karr, H. W.	*London.*
Spooner, T. J. (C.E.)	Dharwar.
Standen, B. (I.C.S.)	Betul, C. P.
Swayne, Herbert C.	*Europe.*
Tata, Dorabji J.	Bombay.
Tejpal, Goverdhundas Goculdas	Bombay.
Tilly, T. H.	Mingin, Burma.
Travancore, H.H. Sultan Rama Raja Bahadoor, G.C.S.I., G.C.I.E., Maharaja of	Trivandrum.
Ulwar, H. H. Jey Singh Bahadoor, the Maharaja of	Ulwar.
Unwalla, J. N.	Bhownagar.
Viccaji, Framji R.	Bombay.
Whitworth, The Hon'ble Mr. G. C. (I.C.S.)	Satara.
Wroughton, R. C.	*Europe.*
Yerbury, Col. J. W.	*Europe.*

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Forel, Professeur Auguste	*Europe.*
Heeckerenez, Le Baron Von	Java.
Kerkhoven, E. J.	Java.
Oates, E. W.	*Europe.*

MEMBERS.

Abdy, Major A. J. (R.A.)	South Africa.
Abercrombie, A.	*Europe.*
Acworth, E. C. B.	Bombay.
Aga Khan, His Highness Aga Sultan Mahomed Shaha (Life Member)	Bombay.
Aga Shaha Rookh Shaha, H.H.	Poona.
Agricultural and Horticultural Society of India, The Secretary	Calcutta.
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Ainslie, Capt. H. P.	Vizianagram.
Ainsworth, Capt. H. (I.M.S.)	Chumba, Punjab.
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Alderson, M. J.	Ceylon.

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Allen, C. E. (I.F.S.)	Tharrawaddy, Lower Burma.
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Allum, E. F.	Bombay.
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Alston, G. C.	Ceylon.
Ameerudin Tyabjee	Bombay.
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Anderson, J. C.	*Europe.*
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Anderson, Lieut. R. H.	Derah Ismail Khan.
Andersonn, M.	Calcutta.
Annesley, F. C.	Bombay.
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Antram, C. B.	Cachar.
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Bailey, F. M.	Tibet Frontier Commission.
Bailward, Lt.-Col. A. C. (I.A.)	Allahabad.
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Baput, S. K.	Dhulia.
Barker, P. W.	Neschindipur, E. P. Ry.
Barlow-Poole, B. H. (I.F.S.)	Anantapur.

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Barnard, R. C. H.	Poona.
Barnes, Capt. E.	Dhar, C. I.
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Bell, T. R. D. (I.F.S.)	Karachi.
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Benson, W. A. (C.E.)	*Europe.*
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Betham, J. A.	Purnea, Bengal.
Betham, Major R. M.	*Europe.*
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Beyts, C. A. (I.C.S.)	Karachi, Sind.
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Bhatavadekar, Sir Bhalchandra Krishna	Bombay.
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Bomanji, K. R. (I.C.S.)	Bijapur.
Bombay Government, The Chief Secretary, Separate Department	Bombay.
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Brendon, C. R.	*Europe.*
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Brodie, N. S. (I.C.S.)	Bombay.
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Brooke, R. H.	Bombay.
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Brown, Capt. H. R. (I.M.S.)	Secunderabad.
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Bulkley, W. W.	Jeypore.
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Burkill, J. H. (M.A.)	Calcutta.
Burn, J. G. (I.C.S.)	Madras.
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Burns, C. L.	Bombay.

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Burton, Capt. Richard W.	Aurungabad.
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Butler, Lieut. H. M.	Bombay.

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Calder, H.	Rangoon.
Cama, K. R. (Life Member)	Bombay.
Cama, Dr. Maneckjee D. (Life Member)	Bombay.
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Cameron, H. S.	Ceylon.
Cameron, W. L. (C.E.)	Belgaum.
Campbell, Lieut. D. (Life Member)	*Europe.*
Campbell, Capt. J.	Simla.
Campbell, Revd. W. Howard	Gooty, Madras Presidency.
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Capper, Col. W.	Simla.
Carr, R. C. C. (I.C.S.)	Chittoor, N. Arcot.
Carter, Lt. R. M. (I.M.S.)	Sanawi, S. Arabia.
Cassamali Jairajbhoy Peerbhoy	Bombay.
Cassels, Mrs. Herbert	Calcutta.
Cayley, Dr. C. H. (M.A., M.B.)	Bombay.
Chaldecott, Lt. W. H. (R.E.)	Somaliland.
Chalmers, H.	*Europe.*
Chanter, F. W. (C.E.)	Bombay.
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Chapman, Major L. P. (R.E.)	Bombay.
Chapman, Capt. P. F. (I.M.S.)	Jabalpur, C. P.
Chico, J. R. (C.E.)	Baroda.
Chitty, C. W.	Bombay.
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Christy, Dr. C.	*Europe.*
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Clark, W. H.	Kamptee, C. P.
Clarke, Lt. F. Stanley	*Europe.*
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Clarke, L. O. (I.C.S.) (Life Member)	Ajal, Assam.
Clarke, Robt. L. H. (I.C.S.)	Sultanpur.
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Clifford, Lt. R.	Sadon, Myictyina, Burma.

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Coates, Lt. E. C.	Meerut.
Coates, Lt. Victor	Kirkee.
Cobbe, Capt. C. C.	Waltair.
Coen, W. W.	Hubli, S. M. Ry.
Coggan, R. T.	Calcutta.
Coghill, Capt. N. S. (I.A.)	Radhanpur.
Cogill, Dr. H. (M.R.C.S., L.R.C.P.)	Sholapur.
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Collie, R. A.	Dibrugarh, Assam.
Colombo, The Librarian, Colombo Museum	Colombo.
Colston, Captain H. K.	Mhow.
Coltart, Dr. H. N. (Life Member)	Dibrugarh.
Comber, Edward (F.Z.S.)	Bombay.
Conduitt, W. A. (C.E.)	Bombay.
Conley, Andrew	Calcutta.
Constable, F. A.	New York, U.S.A.
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Cooke, J. V.	Surat.
Cooper, R. W.	Karachi.
Coppinger, Lt. W. V. (I.M.S.)	*Europe.*
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Coventry, B. O. (I.F.S.)	Lahore.
Coventry, E. M. (I.F.S.)	Naggar Kulu, Kangra District.
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Covernton, J. G.	Ahmedabad.
Cox, Major P. Z. (F.Z.S., F.R.G.S., C.I.E.)	Bushire.
Cox, S. (I.F.S.)	Coimbatore.
Craddock, W. H. (I.F.S.)	Rangoon.
Crampton, M.	Russelkonda, Ganjam District.
Crawford, Leslie	Bombay.
Crawford, W. M. (I.C.S.)	*Europe.*
Creaghe, P. F. S.	Kirkee.
Crerar, J. (I.C.S.)	Larkhana, Sind.
Crofts, Lt.-Col. A. M. (I.M.S.)	Jodhpore.
Croly, Lt.-Col. A. E. J. (R.A.M.C.)	*Europe.*
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Crum, W. E.	Bombay.
Crump, L. C. (I.C.S.)	Ratnagiri.
Cubitt, G. E. S. (I.F.S.)	Kindat, Burma.

Cuffe, T. W.	Bombay.
Cumming, W. D.	Muscat, Persian Gulf.
Cumming, Major W. H. (R.G.A.)	*Europe.*
Curreembhoy Ebrahim	Bombay.
Currey, E. S.	*Europe.*
Currey, Lieut. V. F.	Karachi.
Currie, R. G.	Calcutta.
Cursetji, Khan Bahadur C. M. (Life Member)	Bombay.
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Danson, J. W. W.	Rangoon.
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Davidson, H. M. M.	Darrang Assam.
Davidson, J. (I.C.S.)	*Europe.*
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Davis, Major R. E. S. (I.M.S.)	Rangoon.
Dawson, G. B.	Rangoon.
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Deane, H. H. (C.E.)	Mhow, C. I.
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De Courey, Hon'ble M. W. R.	Ahmednagar.
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Delme-Radcliffe, Lieut. S.	Kirkee.
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Dewar, D. (I.C.S.)	Madras.
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Dhunjibhoy Bomanji (Life Member)	Bombay.
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Donald, C. H.	Vizianagram, Vizagapatam Dist.
Donovan, Major C. (I.M.S.)	Madras.
Douglas, D.	Dibrugarh, Assam.
Douglas, S. M. (S. O.)	Mandalay.
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Drake-Brockman, Capt. D. H.	Tibet Mission.
Drake-Brockman, Maj. H. E. (I.M.S.) (Life Member)	Bhurtpur.
Drake-Brockman, Capt. V. G. (I.M.S.)	Bharatpur.
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Dumayne, F. G.	Calcutta.
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Dwane, E. H.	Secunderabad.
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Eden, Morton	Nazira, Assam.
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Eliot, Lieut. Neville (R.A.)	Quetta.
Elles, Lieut. H. J. (R.E.)	Roorke.
Elliot, Lieut. C.	Rangoon.
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Elsworthy, E. H.	Bombay.
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Enthoven, R. E. (I.C.S.)	Poona.
Evans, Vety.-Major G. H. (F.L.S.)	Rangoon.
Evans, Lt. W. H. (R.E.)	Jubbulpore, C. P.
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Fagan, H. R.	Rangoon.
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Finlay, C. K.	Rangoon.
Fischer, C. E. C. (I.F.S.)	Chatrapur.
Fisher, W. F. D. (I.F.S.)	Thana.
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Fleming, W. N.	*Europe.*
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Fletcher, F. E.	Calicut.
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Forbes, C. H. B.	Bombay.
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Forbes, J. D.	Jubbulpore, C. P.
Forbes-Sempill, The Hon'ble R. A.	Bangkok, Siam.
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Foulkes, Capt. H. D.	Mean Meer.
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Fraser, S. M. (I.C.S., C.I.E.)	Gwalior, C. I.
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Galloway, R.	Secunderabad.
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Gaye, W. C.	Secunderabad.
George, C. P.	Secunderabad.
Gerhardt, Paul	Bombay.
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Gilbert, Reg. (F.Z.S.)	*Europe.*
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Gillum, S. J.	Bombay.
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Giro, C. G.	Calcutta.
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Godfrey, G. C.	Calcutta.
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Gonsalves, Dr. J. F.	Bandra. [States.
Gordon, D. M.	Taunggyi, S. Shan
Gore, F. C.	Sibsagar, Assam.
Gore, Col. St. G. C. (R.E.)	Calcutta.
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Graham, D. N.	Bombay.
Graham, J. A.	Mercara, Coorg.
Graham, Capt. R. B.	Rangoon.
Grant, John F.	Nazira, Assam.

Grant, C. F. (I.C.S.)	Rangoon.
Gray, Chas.	Coonoor.
Greany, Lieut.-Col. J. P. (I.M.S.)	Karachi.
Greaves, S. E.	Bombay.
Green, E. Ernest (F.E.S.)	Ceylon.
Gregerson, Dr. J. D.	Dibrugarh, Assam.
Greig, Joseph	Cachar.
Griffith, F. C.	Hyderabad, Sind.
Griffiths, V. M. (P.W.D.)	Nasik.
Grubbe, Major E. A.	*Europe.*
Habibuddin, S. (N.C.S.)	Hyderabad,Deccan.
Haigh, P. B. (I.C.S.)	Karwar.
Hale, Major C. H. (R.A.M.C.)	Rangoon.
Hall, William	Ahmedabad.
Hamerton, Capt. A. E. (R.A.M.C.)	Ferozepore,Punjab.
Hampson, Sir George F. (Bart.) (F.L.S., F.E.S.)	*Europe.*
Hankin, A. C. (C.I.E.)	Secunderabad.
Hannyngton, F. (I.C.S.)	Ootacamund.
Hannyngton, W. O.	Kawlin, Burma.
Hanson, C. O. (I.F.S.)	*Europe.*
Harcourt, Capt. J. S. M.	Dehra Dun, N. P.
Hardy, A. W.	Talup, Assam.
Harington, Capt. H. H.	Monywa, Burma.
Harington, Lt.-Col. V. (I.M.S.)	Mount Abu.
Harper, E. W. (F.Z.S.)	*Europe.*
Harris, Major E. W.	Vizagapatam.
Harrison, A. J.	Lakhimpur, Assam.
Hart, E. H.	Parel.
Harter, R. W.	Bombay.
Harvey, Capt. W. F. (I.M.S.)	Lahore.
Harvey, W. L. (I.C.S.)	Bombay.
Harwood, Lieut.-Col. J. G. (R.A.M.C.)	Poona.
Haslope, Rev. L. M.	Bombay.
Hasted, Capt. A. W.	Kasauli.
Hasted, H. R. G.	Koraput, Vizagapatam District.
Hasted, W. A.	Nellore, Madras.
Hatch, Major A. E.	Karachi.
Hatch, G. W. (I.C.S.)	Belgaum.
Hatch, Lt.-Col. W. K. (I.M.S.)	*Europe.*
Hatchell, D. G.	Madras.
Hate, Vinayek N.	Bombay.
Haughton, Samuel (C.C.S.)	*Europe.*
Hauxwell, T. A. (I.F.S.)	*Europe.*
Hawkins, A. B.	Calcutta.
Hay, Surg.-Genl. G. W. R. (I.M.S.)	Ootacamund.
Hayden, H. H.	Calcutta.

Hayter, O. C. G.	Ajmere.
Hearsey, Mrs. L. D.	Ranikhet.
Hearsey, T. N. (I.F.S.)	Kollegal, N. Coimbatore Dist.
Heath, R. H. (C.E.)	Sirsa, Punjab.
Heeckerenz, Baron Von (Hon. Corrpg. Member)	Java.
Henderson, Capt. R. R.	Sialkot.
Herbert, Major H. (I.M.S.)	Bombay.
Hertz, W. A.	Myitkyina, U. Burma.
Heygate, Major R. H. G. (D.S.O.)	Thayetmyo, Burma.
Hickman, R. St. J.	Cachar.
Hicks, E.	Tezpur, Assam.
Hide, P. (Life Member)	Poona.
Higgins, J. A. (D.S.P.)	Mundla, C. P.
High Range Natural History Society, The President	Aneimudi, Munaar P. O.
Hill, Claude H. (I.C.S., C.I.E.)	Poona.
Hill, F. J. A.	*Europe.*
Hill-Trevor, Hon'ble A. E.	Bombay.
Hine-Haycock, A. L.	Colombo, Ceylon.
Hodgkinson, Capt. C.	Lucknow.
Hodgkinson, Col. H.	*Europe.*
Hoghton, Major F. A.	*Europe.*
Hodgson, C. P.	Ootacamund.
Hojel, Major J. G. (I.M.S.)	*Europe.*
Holbrooke, Capt. B. F. R.	Poona.
Hole, H. A.	Cachar.
Hole, R. S. (I.F.S.)	Dehra Dun.
Holmes, Capt. G. V.	Kherwara.
Holyoak, Bernard	Bombay.
Hoosein Belgrami, The Hon'ble Mr. Syed Nawab Imud-ul-mulk Bahadoor	Hyderabad, Deccan.
Hooton, Capt. A. (I.M.S.)	Bijapur.
Hope, A. J. R.	*Europe.*
Hopwood, J. C.	Kyankse, Upper Burma.
Hornidge, S.	*Europe.*
Hotson, J. E. B. (I.C.S.)	Rajkote, Kathiawar.
Howell, E. B.	Nanking, China.
Howlett, Col. A. (I.S.C.)	*Europe.*
Hudson, Capt. C. T. (I.M.S.)	Satara.
Hudson, C. W. M. (I.C.S.)	Kaira.
Hudson, Lt. P.	Rangoon.
Huggins, J. R.	Koraput.
Hulbert, Major J. G. (I.M.S.)	Naini Tal.
Hume, H. R. (D.S.P.)	Kaira.
Humphrey, J.	Bombay.
Humphrys, Lieut. F. H.	Lahore.

Hunt, C. B. Holman	Munnar P. O., S. India.
Hunt, Dr. E. H.	Secunderabad.
Hutchinson, Lt. C. G.	Burma Minbu.
Hutchinson, F. G.	Karwar.
Hutchinson, F. T.	Nasik.
Hyam, Judah (Life Member)	Poona.

Ichalkaranji, The Hon'ble Narayenrao Govind, *alias* Babasaheb Ghorpade, Chief of, (Life Member)	Kolhapur.
Ilbert, L. G.	Sibsagar, Assam.
Imray, Robt. S.	Peermaad, Travancore.
Indore, H.H. the Maharaja Tukuji Rao, Holkar of (Life Member)	Indore.
Ingle, F. A.	Bombay.
Inglis, Chas. M. (Life Member)	Durbhanga.
Inverarity, J. D. (B.A., LL.B.) (Life Member)	Bombay.
Ivens, J. H. (P.W.D.)	Agra.

Jamkhandi, Shrimant Parashram Ramchandra Patwardhan, The Chief of, (Life Member)	Kolhapore.
Jamsetji, M., Doctor	Bombay.
Janjira, H.H. Sir Sidi Ahmed Khan, (K.C.I.E.) Nawab of, (Life Member)	Janjira.
Jardine, A. J. A. (D.S.P.)	Myilkyina, Burma.
Jardine, E. R.	Bombay.
Jardine, M. R.	Bombay.
Jardine, W. F.	Thana.
Jayakar, Lt.-Col. A. S. G. (I.M.S.)	Bandora.
Jellett, H. H.	Calcutta.
Jennings, Major W. E. (I.M.S.)	Bombay.
Jermyn, Lt.-Col. T.	Bellary.
Jesse, William	Meerut.
Jewett, Miss L.	Dhubri, Assam.
John, H. C. (C.E.)	Satara.
Johnson, S. M.	Cawnpore.
Johnston, J. C. R.	Calcutta.
Johnstone, J. W. D.	Gwalior, C. I.
Jones, Major F. W. C. (R.A.M.C.)	Nasirabad.
Jones, Major J. Lloyd (I.M.S.)	Calcutta.
Jones, Capt. M. D. Goring	Nagpur, C. P.
Jones, T. M.	Rangoon.
Jowitt, John F.	Bandarwella, Ceylon.
Joyce, S.	Bombay.
Jukes, J. E. C. (I.C.S.)	Ahmedabad.
Julius, Capt. S. de V. A.	Delhi.

Karachi, The Curator, Victoria Museum	Karachi, Sind.
Kasauli, The Secretary, Kasauli Club	Kasauli.
Kearns, A. S.	*Europe.*
Keary, Lt.-Col. H. D.	Rangoon, Burma.
Keighly, Lt. H. D. S.	Myitkyina, Burmah.
Kellie, Col. R. H.	*Europe.*
Kelly, B. P.	Mansi, Banmank Katha, Burma.
Kelly, Capt. C. R. (R.G.A.)	Aden.
Kelsall, Capt. H. J. (R.A.)	*Europe.*
Kemball, H. V. (C.E.)	Bombay.
Kemp, Capt. D. C. (I.M.S.)	Madras.
Kemp, N. W.	Bombay.
Kendall, C. H. B. (I.C.S.)	Gonda, Oudh.
Kendall, Capt. C. J. (R.I.M.)	Bombay.
Kennedy, R. M. (I.C.S.)	*Europe.*
Kenny, S. D. (I.F.S.)	Chanda, C. P.
Kenyon, James	Karachi.
Ker, L. B.	Bombay.
Kergarion, Comte de	Paris.
Kerkhoven, E. J. (Hon. Correspg. Member)	Java.
Kerr, Dr. A. F. G.	Chiengmai, Siam.
Keys, H. W. (I.F.S.)	Satara.
Khan, Muncherji Framji	Colombo, Ceylon.
Khareghat, M. P. (I.C.S.)	Dharwar.
Kinloch, A. M.	Kil-Kotagiri, Nilgiris.
Kirkpatrick, W. McColin	Delhi.
Kirtikar, Lt.-Col. K. R. (I.M.S.)	Ratnagiri.
Knox, Major A. R. (R.F.A.)	Barrackpore.
Knyvett, W. A.	Gaya, Bengal.
Kolhapur, H.H. the Maharaja Sir Shahu, Chhatrapati (G.C.S.I, G.C.V.O.) (Life Member)	Kolhapur.
Kotah, H.H. the Maharaja Umed Sing, Bahadoor (K.C.S.I.) (Life Member)	Kotah.
Kunwar Kushal Pal Singh	Rais Kotila, Agra Dist.

Lace, John H. (I.F.S., F.L.S.)	*Europe.*
Laird-MacGregor, E. G. L. (I.C.S.)	Karwar.
Lamb, Capt. Geo. (I.M.S.)	Kasauli, Punjab.
Lamb, R.A. (I.C.S., C.I.E.) (Life Member)	Poona.
Lamington, H. E. Lord (G.C.M.G., G.C.I.E.)	Poona.
Land Records and Agriculture, The Director of	Poona.
Lane, Capt. W. H.	Kalemyo, U. Burma.
Lang, Capt. C. F. G.	Madras.
Langham, Arthur	Bombay.

Lawrence, Mrs. E.	*Europe.*
Lawrie, A. S.	Dowlaishweram, Godavari Dist.
Lee, Capt. A. W. H.	With the Somaliland Field Force.
Lees, D. H. (Life Member)	Tezpur, Assam.
Leete, F. A. (F.C.H., I.F.S.)	Minbu, Burma.
Lefroy, H. M. (M.A., F.E.S., F.Z.S.)	Surat.
Lely, Hon'ble Mr. F. S. P. (I.C.S., C.S.I.)	Nagpur.
Le Mesurier, H. P. (C. E.)	Calcutta.
Lennox, Lt. G. M.	Kamaing, U. Burma.
Leslie, A. K.	Bombay.
Leslie, Major G. A. (R.E.)	Kirkee.
Lester, Major C. D.	Fort Sandeman.
Lethbridge, Capt. W. (I.M.S.)	Muscat.
Light, Lt.-Col. R. H.	Fort Sandeman.
Light, Capt. W. A.	Saugor, C. P.
Lightfoot, S. St. C.	Taunggyi, U. Burma.
Lincoln, Capt. C. H. (I.M.S.)	Bombay.
Linnell, Fred.	Rangoon.
Liston, Capt. W. G. (I.M.S.)	Parel.
Little, F. D.	Banmauk P. O., Katha, U. Burma.
Lloyd, Col. O. E. P. (V.C., R.A.M.C.)	Ootacamund.
Loam, Mathew	Berhampur.
Lock, Capt. F. R. E. (I.S.C.)	Aden.
Lodge, G. E.	*Europe.*
Logan, A. C. (I.C.S.)	Satara.
Long, G. R. (I.F.S.) (Life Member)	Minbu, U. Burma.
Long H. W. (R.A.M.C.)	Jullundur.
Lory, F. B. P. (M.A.)	Ahmedabad.
Loudon, Major J. A.	Singapore, S. S.
Lovegrove, W. H. (I.F.S.)	Kotedwara.
Lowndes, G. R.	Bombay.
Lowrie, A. E. (I.F.S.)	Raipur, C. P.
Luard, E. S.	*Europe.*
Lucas, C.	Bombay.
Lucknow, The Curator & Sec., Provincial Museum	Lucknow.
Lumley, Major F. D.	*Europe.*
Lyall, Lt. R. A.	Jodhpur.
Lyell, Lt. A. G.	Lansdowne.
Lynch, C. B.	Bombay.
Lynn, G. R. (C.E.)	Baroda.
Macaulay, L. A.	Bombay.
Macaulay, R. H.	*Europe.*
MacDonald, Dr. D. (Life Member)	*Europe.*

MacDonald, J.	Bombay.
MacDonald, K. C. (D.S.P.)	Pokukku, Burma.
MacLeod, Capt. E. C. (I.M.S.)	Aijal, Lushai Hills.
MacMillan, D. A.	Keonjhar, Orissa.
Mackay, C. J.	Mozufferpur.
Mackay, E. D.	Sibsagar, Assam.
Mackenzie, Major A. F.	Poona.
Mackenzie, Colin A.	Ootacamund.
Mackenzie, Kenneth	Kurnool, Madras.
Mackenzie, Lt. K. L. W.	Fyzabad.
Mackenzie, M. D.	Hyderabad, Sind.
Mackenzie, M. M.	Chapra, Bengal.
Mackinnon, P. W. (F.E.S.)	Mussoorie, N.-W.P.
Mackwood, F. M.	Colombo.
Maclaren, J. Malcolm (F.G.S.)	Calcutta.
Macleod, Norman A.	Jaffirbund.
Macleod, N. C.	Bombay.
Macnaghten, H. W. P.	Bombay.
Macpherson, John	*Europe.*
Macpherson, Col. T. R. M.	*Europe.*
Mactaggart, H. B.	Negapatam.
Madras, The Professor of Zoology, Madras Christian College	Madras.
Madras, The Principal Medical College	Madras.
Madras, The Principal Presidency College	Madras.
Madras, The Librarian, Govt. Central Museum	Madras.
Magrath, Major H. A. F.	*Europe.*
Mahaluxmiwalla, C. D.	Bombay.
Mahomedbhoy Currimbhoy Ebrahim	Bombay.
Mair, A.	Calcutta.
Maitland, Lt.-Col. C. B. (I.M.S.)	*Europe.*
Major, Capt. F. F.	Jalna, Deccan.
Malcolm, T.	Rajamundry.
Mallins, Col. C. (I.M.S.)	*Europe.*
Manders, Major N. (R.A.M.C.)	*Europe.*
Mandlik, Narayan V. (Life Member)	Bombay.
Mann, H. H.	Calcutta.
Manners-Smith, Major J. (V.C., C.I.E.)	Neemuch, C. I.
Manson, Lieut. B. E. A.	Belgaum.
Manson, C. E. F.	Rangoon.
Manson, F. B. (I.F.S.)	Rangoon.
Marjoribanks, G. (I.F.S.)	Belgaum.
Marryat, N.	Bombay.
Marsden, E.	*Europe.*
Marshall, Arch. McL. (Life Member)	*Europe.*
Marshall, J. McL. (Life Member)	*Europe.*
Marshall, Capt. T. E. (R.A.)	*Europe.*
Marston, G. D. (C.E.)	Bombay.

Marten, James	... DehraDun, N.-W.P.
Martin, Lieut.-Col. Gerald (Life Member)	... *Europe.*
Martin, L. K.	... Buldana.
Masani, A. M. (Life Member)	... Baroda.
Masson, The Hon'ble Mr. D. P. (C.I.E.)	... Lahore.
Masson, W. P.	... Darjeeling.
Massy, Major H. S.	... *Europe.*
Maxwell, F. D.	... Maubin, Burma.
Maxwell, W.	... Sibsagar, Assam.
Maxwell, Lt. W. F. (R.E.)	... Kirkee.
Mayne, Capt. H. B. (R.G.A.)	... *Europe.*
McCarrison, D. L. (D.S.P.)	... Koraput.
McCauseland, S. M.	... Bombay.
McCormack, R. B.	... Cocanada, Godavari District.
McDougall, E. (D.S.P.)	... Sandoway, Burma.
McGlashan, John (C.E.)	... Calcutta.
McIntosh, Alex. (C.E.)	... Quilon, Travancore.
McIntosh, R. (I.F.S.)	... Dehra Dun.
McKay, Lt.-Col. H. K. (I.M.S.) ...	... Calcutta.
McKearon, R. G. (M.A., I.C.S.) ...	... Rangoon.
McKenna, J. (I.C.S.)	... Bassein, Burma.
McKenna, Lieut. J. C.	... Myitkyina, Burma.
McKenzie, Alex.	... Bombay.
McLaughlin, Lt. H. D.	... Silchar, Cacher.
McLeod, Major-Genl. D. J. S. (C.B., D.S.O.)	... Rangoon.
McMahon, Major A. H. (C.I.E., C.S.I.) ...	... Quetta.
McMullen, Dr. G. C.	... Kotri, Sind.
McNeil, J. (I.C.S.)	... Bombay.
Mead, Capt. H. R.	... Deolali.
Mead, P. J. (I.C.S.)	... *Europe.*
Mears, Capt. A. (I.A.)	... Calcutta.
Meinertzhagen, Lieut. R.	... Mombassa.
Menon, K. G.	... Trichor, Cochin.
Merewether, Major H. D.	... Palanpur.
Merwanji Pallonji Talati	... Bombay.
Mess President, 34th Battery, R. F. A. ...	... Campbellpore.
Mess President, 110th Maratha L. Infantry	... Hongkong.
Mess President, 130th Baluchis ...	... Hyderabad, Sind.
Mess President, South Wales Borderers	... Dalhousie.
Mess President, R.A.	... Roorkee.
Messent, P. G. (C.E.)	... Bombay.
Metcalfe, T. J.	... Rangoon.
Metge, Lt. R.	... Subathu.
Meyer, Major C. H. L. (I.M.S.) ...	... Bombay.
Meyer, Dr. F. A.	... Bombay.
Meyer, O.	... Bombay.
Millard, W. S.	... Bombay.

Miller, G. A.	Darjeeling.
Millett, G. P. (I.F.S.)	Bombay.
Mills, J. D. (Life Member)	*Europe.*
Milne, Major C. J. Robertson (I.M.S.)	Purulia.
Minniken, G. G. (I.F.S.)	Simla.
Miraj, Shrimant Gungadharrao Ganesh, *alias* Babasaheb Patwardhan, Chief of (Life Member)	Miraj.
Mitchell, J. C. H.	Tezpur, Balipara P.O., Assam.
Mitchell, Dr. W.	*Europe.*
Mockler, Major G. F.	Subathu.
Modi, Bomanji Edulji	Kaira.
Moggridge, C. B.	Rangoon.
Möller, F. A.	Darjeeling.
Mollison, J.	Nagpur, C. P.
Monté, Mrs. Cecilia de (L.M. & S.)	Bombay.
Monté, Dr. D. A. de (L.M. & S.)	Bandora.
Monteath, G. (I.C.S.)	Dharwar.
Monteath, J. (I.C.S.)	Dharwar.
Moore, T. D.	Bombay.
Moore, T.	Russelkonda, Ganjam District.
Moore, W. (F.I.C.)	Dibrugarh.
Morgan, V. G. (I.F.S.)	Munda, C. P.
Morgan, W. de (C.E.)	Waltair, Vizagapatam District.
Morison, W. T. (I.C.S.)	Surat.
Morley, G. S. (C.E.)	Nagpur, C. P.
Morris, Capt. A. H. (R.A.M.C.)	Bombay.
Morris, Capt. D. O.	Amraoti, Berar.
Morris, G. C.	Ceylon.
Morris, Capt. G. M.	Secunderabad, Deccan.
Moscardi, E. H. (I.C.S.)	*Europe.*
Mosse, Lt. A. H. E. (I.S.C.)	Sadra, Mahikantha.
Mowbray, G. B.	Ceylon.
Mowbray, Lt. J. L. (R.F.A.)	Barrackpore.
Moylan, W.	Calcutta.
Mullalay, C. (I.C.S.)	Ootacamund.
Mudhol, Shrimant Malojirao Rage Ghorpade, Chief of	Mudhol, S. M. C.
Müller, Professor O. V.	*Europe.*
Mumford, E. G. (D.S.P.)	Maubin, Burma.
Mumford, J.	Bombay.
Mundy, N. S.	Dibrugarh, Assam.
Munna Lâl, Dr.	Ballia, N.-W.P.
Murray, S. B. (P.W.D.)	Ootacamund.

Muspratt, E. (D.S.P.) (Life Member)	Tezpur, Assam.
Muspratt, Major F. C.	Shau-hai-Kwan, N. China.
Mysore, The Superintendent, Mysore Government Museum	Bangalore.
Mysore, H.H. the Maharaja Krishna Raj Woodayar Bahadoor of, (Life Member)	Mysore.
Nagpur, The Curator, Central Museum	Nagpur.
Nangle, H. C.	Kyaikto, Thaton District, Lower Burma.
Nangle, Capt. K. E.	Aurungabad.
Nangle, Lt. M. C.	Mandalay.
Napier, F.	Karachi, Sind.
Naranji Dwarkadas (Life Member)	Bombay.
Narrotumdas Morarji Goculdass (Life Member)	Bombay.
Navanagar, H.H. Maharaja Shri Jaswat Singji, the Jam Saheb of (Life Member)	Rajkote.
Nelson, Major H. S. (R.G.A.)	Bombay.
Newill, F. N. C.	*Europe.*
Newnham, Major A. (F.Z.S.)	Lucknow.
Nicholson, E. F.	*Europe.*
Nicholson, Capt. W. C.	*Europe.*
Nigel-Jones, M. E.	Dibrugarh, Assam.
Nisbett, Capt. W. G.	Katha, Upper Burma.
Northcote, H. E. Lady	Australia.
Northcote, H.E. Lord	Australia.
Norvill, Dr. T. H. (M.D.)	Lakhimpur.
Nurse, Major C. G. (F.E.S.) (Life Member)	Quetta.
Nurse, Capt. H. H.	Aden.
Nuttall, W. M.	Dibrugarh, Assam.
Oakden, R. M. (I.C.S.)	Meerut.
Oakes, George	Ootacamund.
Oates, E. W. (Hon. Correspg. Member)	*Europe.*
O'Brien, Capt. Edward	Amreli, Kathiawar.
O'Brien, Hon'ble W. T.	Karachi.
Ogilvie, A. W. (I.F.S.)	Chiengmai, Siam.
Ogilvie, Capt. E. C. (R.E.)	Poona.
Okeden, W. P.	Rangoon.
Oldham, Capt. L. W. S. (R.E.)	*Europe.*
Oliver, A. K.	Bombay.
Oliver, J. W. (I.F.S.)	*Europe.*
Olivier, Lt.-Col. H. D. (R.E., F.Z.S.) (Life Member)	Bombay.
Ollivant, Capt. A. H.	Somaliland Field Force.

Opiumwalla, Dorab E.	Bombay.
Orr, J. P. (I.C.S.)	Thana.
Osborn, Lt.-Genl. W.	Hoshiarpur.
Osmaston, B. B. (I.F.S.)	Darjeeling.
Osmaston, L. S. (I.F.S.)	Dhulia.
Oxley, Lt. J. C. S., (I.M.S.)	Seoni, Chappara.
Ozzard, Major F. R. (I.M.S.)	Tongshan, N. China.

Packard, Capt. H. N. (R.A.)	Ootacamund.
Page, W. G.	*Europe.*
Page, W. T. (F.Z.S.)	*Europe.*
Pam, Albert	*Europe.*
Parrington, Lt. J. W. (R.A.)	*Europe.*
Parsons, H. J.	*Europe.*
Parasu Ramdas Patro, A. (B.A.)	Berhampur.
Partridge, Henry (Life Member)	Pyinmana, Burma.
Patterson Dr. R. L.	Sibsagar, Assam.
Patton, Lt. W. S. (I.M.S.)	Bombay.
Pawalla, Jamsetji C.	Bombay.
Payn, Capt. W. A.	Bareilly.
Pearce, Capt. C. R. (I.M.S.)	*Europe.*
Pearless, S. H.	Ceylon.
Pearson, R. S. (I.F.S.)	Dhulia.
Pechey-Phipson, Mrs. (M.D.)	Nasik.
Peiniger, W. G.	Chiengmai, *viâ* Moulmein.
Peirce, H. B.	Bombay.
Penno, Dr. F. L. (M.R.C.S, L.R.C.P.)	Bombay.
Perreau, Capt. G. A.	Bakloh, Punjab.
Perrot, Lt. H. S. (R.G.A.)	Rawal Pindi.
Pershouse, Lt. S.	Burma, Meiktila.
Pestonji Jivanji (N.C.S.) (Life Member)	Hyderabad, D.
Peters, Lt.-Col. C. T.	Dinajpur.
Petit, Bomanji Dinshaw (Life Member)	Bombay.
Petit, Dhunjibhoy Bomanji (Life Member)	Bombay.
Petit, Jehangir Bomanji (Life Member)	Bombay.
Phear, G. A. (P.W.D.)	Nagpore, C. P.
Phillott, Col. D. C.	Kareman, Persia.
Phipps, Henry	*Europe.*
Phipson, H. M. (C.M.Z.S.) (Life Member)	Bombay.
Pilcher, Capt. A. J. (R.E.)	*Europe.*
Pilcher, Col. J. G. (I.M.S.)	*Europe.*
Pinhey, Major A. F. (C.I.E.)	Oodeypur.
Pink, H. F. L.	Dehra Dun.
Pocock, Capt. P. F.	Baroda.
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Poncins, Baron Edmond de (Life Member)	*Europe.*
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Powell, Lt. A. E. (R.E.)	Kirkee.
Prain, Major D. (I.M.S.)	Calcutta.
Prall, Major S. E. (I.M.S.)	Aden.
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Preston, F. J.	Jubbulpore.
Price, Sir Fred.	Ootacamund.
Prichard, G. M.	Ramtek, C. P.
Priestley, Capt. C. E. N.	Rangoon.
Primrose, Alex. M.	Tanarhat P. O. Gauripur, Assam.
Prior, Major W.	Dilkusha, Oudh.
Proctor, H. E.	Bombay.
Pundit, Jwala Prasad (I.C.S.)	Orai, N.-W. P.
Purkis, H. V.	Tissa, P. O. Chumba State.

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Raikes, E. B.	Bombay.
Ranger, G. O.	Calcutta.
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Reid, Cecil H. (I.C.S.)	Calcutta.
Reid, M. F. (C.I.E.)	Bombay.
Reid, W. J. (I.C.S.)	Sibsagar, Assam.
Rennie, Thos. (I.C.V.D.)	Rangoon.
Reynolds, L. W. (I.C.S.)	Indore, C. I.
Reynolds, P. (C.E.)	*Europe.*
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Rhenius, C. E.	Bellary.
Rhodes, T. M.	Haflong, Cachar.
Rice, Lieut. B. A.	Killa Drosh.
Richards, G. (C.E.)	Rangoon.
Richardson, Cecil	Ahmedabad.
Richardson, H. L.	Byculla.
Richardson, Lt.-Col. W. St. John	Rawal Pindi.
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Robertson, Col. Sir D. (K.C.S.I.)	*Europe.*

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Robertson, J. H. (I.C.S.)	Cuddapah, Madras Presidency.
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Robertson, Lt. W. (R.E.)	Bangalore.
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Robinson, John, J.	Ceylon.
Robinson, Major C. T. (R.F.A.)	Mhow, C.I.
Rodger, A. (I.F.S.)	Pegu, Burma.
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Routh, R. S.	Chittagong.
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Scott, G. C.	Ceylon.
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Scovell, C. E.	Loilem, S. Shan States.

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Sealy, Capt. A. E.	Bakloh, Punjab.
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Young, W. E.	Karachi.
Yule, Lt. R. A.	Calcutta.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS (from 1st January 1903 *to* 31*st December* 1903*).*

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
Balance in Bank on 1st January 1903.	1,436	6	9			
Cash in hand on 1st January 1903 ...	125	0	0			
Petty Cash balance on 1st January 1903	0	14	5			
				1,562	5	2
Donation for special purpose				299	15	0
Subscriptions for 1899 (in arrears)				9	0	0
Do. do. 1900 (do.)				6	0	0
Do. do. 1901 (do.)				120	0	0
Do. do. 1902 (do.)...				749	0	0
Do. do. 1903				8,686	1	11
Do. do. 1904 (in advance)				700	2	0
Do. do. 1905 (do.)				15	0	0
Do. do. Life Membership...				1,048	14	1
Do. do. Journal from Members residing outside of India				134	8	0
Entrance Fees				1,510	0	0
Sale of back Journals, &c.				1,935	0	2
Interest on Government Paper				131	14	6
Interest allowed by Bank				34	0	8
Total ... Rs.				16,941	13	6

EXPENDITURE.		Rs.	a.	p.	Rs.	a.	p.
Rent of the Rooms from 1st December 1902 to 30th November 1903					1,500	0	0
Salaries from 1st December 1902 to 30th November 1903					1,308	0	0
Furniture Account					324	3	6
Library Account					69	8	0
Printing and Stationery					248	3	0
Journal Account—Cost of Printing Journals and Coloured Plates from England					8,073	15	8
General Expenses					2,304	2	5
Balance in Bank on 31st December 1903 ...	Rs	2,912	8	9			
Cash in hand on 31st December 1903	,,	200	0	0			
Petty Cash balance on 31st December 1903 ...	,,	1	4	2			
					3,113	12	11
Total ... Rs.					16,941	13	6

Examined and found correct.
R. A. SPENCE,
Hony. Auditor.

N. C. MACLEOD,
Hony. Treasurer.

BOMBAY 1*st January* 1904.

BOMBAY NATURAL HISTORY SOCIETY.

INVESTMENT ACCOUNT (*from* 1st *January* 1903 *to* 31st *December* 1903).

	Rs.	a.	p.		Rs.	a.	p.
Balance of Rs. 4,800, $3\frac{1}{2}$ °/ₒ Government Paper, deposited with the National Bank of India on 1st January 1903	4,800	0	0	Balance of Rs. 4,800, $3\frac{1}{2}$ °/ₒ Government Paper, deposited with the National Bank of India on 31st December 1903	4,800	0	0
Rs. ...	4,800	0	0	Rs. ...	4,800	0	0

Examined and found correct.
R. A. SPENCE,
Hony. Auditor.

N. C. MACLEOD,
Hony. Treasurer.

BOMBAY, 1st *January*, 1904.

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THE

JOURNAL

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY
H. M. PHIPSON, C.M.Z.S.,
AND
W. S. MILLARD.

VOL. XV, No. 1.

Date of publication, 10th June 1903.

Price to Non-Members... ... ... Rs. 6-0

PRINTED AT THE "TIMES OF INDIA" PRESS,
BOMBAY.

1438·03

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OF THE

BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY

H. M. PHIPSON, C.M.Z.S.,

AND

W. S. MILLARD.

VOL. XV, No. 2.

Date of publication, 28th October, 1903.

Price to Non-Members... ... ... Rs. 6-0

PRINTED AT THE "TIMES OF INDIA" PRESS,
BOMBAY.

2972-03

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H. M. PHIPSON, C.M.Z.S.,

AND

W. S. MILLARD.

VOL. XV, No. 3.

Date of publication, 15th February, 1904.

Price to Non-Members... ... ... Rs. 6-0

PRINTED AT THE "TIMES OF INDIA" PRESS,
BOMBAY.

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VOL. XV, No. 4.

Date of publication, 27th June 1904.

Price to Non-Members... ... ... Rs. 6-0

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VOL. XV, NO. 5.

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